THE

ELECTRICAL REVIEW.

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THE

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(J. A. BERLY'S).

1909 EDITION

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THE DREADNOUGHT RACE.

WHILE public interest is centred on the subject of Naval construction, as it is at the present moment, it may be as well to bring forward a few points in connection with the present methods of Naval administration which affect the engineering world, and electrical engineering in particular, to a grave extent.

The Navy has lately fallen into a spirit of self-advertisement which was absent from it a few years ago. The result is, we are informed, that ships are often hurried off to sea in a very unfinished condition in order to proclaim their efficiency or the efficiency of the Administration, when in reality they are not fit to take their place in the Fleet. With the increasing number of electrical instruments now in use on board a man-of-war, many of which are designed to replace machinery driven by steam or hydraulic power, the effect is disastrous to the electrical trade. Tests are necessarily hurried through, and the wiring is often in a very unfinished state, practically inviting trouble.

A machine is handed over to the ship's staff, who have not had time or opportunity to acquaint themselves with its details, and breakdowns, partial or otherwise, occur. It is impossible always to foresee weak points, which begin to reveal themselves in practice, and it is only by a certain amount of preliminary training in the handling of a machine that the best work can be got out of it.

To take a typical case, we may quote a curious accident that occurred with an electric boat-hoist a short time ago. In these boat-hoists the load is usually lowered by a foot brake, and in the case referred to a boat, after being hoisted inboard, was being lowered into its crutches.

The order to stop lowering was given, but the motor could not be brought up. The operator pressed on the foot lever with all his might, but it was evident that the brake was powerless to hold the load, and the boat continued to descend, until finally it rested in such a position on the boat deck as to do a considerable amount of damage. "Curse these electric boat-hoists" is the natural ejaculation of the Commander, and the odds are that in comparison with the steam hoist, its electrical substitute gets unfavourably reported on.

What really happened, of course, was that the foot lever worked loose, and instead of falling into its guiding slot rested on the edge of the guide, where, press how he might, the operator could get no further brake power. The simple remedy was to cut off the corners of the guides and make the slot V-shaped.

It is only by the elimination of such little defects that new machinery becomes perfect in its practical application. The feverish haste to get a ship out of dockyard hands in advance of her estimated time, for the sole purpose of advertising administrative efficiency, is in this manner as unsatisfactory to the various constructive departments as it

is to those who have to take over the machinery after a hurried test, without having an opportunity to master the details of mechanism which may be entirely new to them.

It used to be the practice to allow a newly-commissioned crew a few weeks to settle down and get familiarised with their ship, before they were called upon to take part in the general competition for efficiency throughout the Fleet. In the words of the sergeant-instructor: "What has been learned in slow time, may be done at the quick." As things at present go, everything is attempted at "the quick" from the start. Work is hurriedly finished off, officers and crew are thrown on board at the last moment, and the ship is sent to sea to take part in a political cruise from which she is expected to return with credit to all concerned. Is it to be wondered at that the bill for repairs when she does return is enormous?

ELECTRIC LIGHTING ACTS (AMENDMENT) BILL.

After the lapse of five years, the Government have resumed their attempt to amend the Electric Lighting Acts, and a Bill has been introduced into the House of Lords by Lord Hamilton of Dalzell, for the purpose.

As a preamble the Bill contains an explanatory memorandum, which is a wise proceeding under the circumstances, as the abortive efforts at legislation spread over so many years, and with long periods of absolutely doing nothing, render it necessary to refresh the memory as to the position of the case.

During the lapse of time since the Bill of 1903 was introduced, a change of Government has taken place, and this may account for the absence from the present Bill of one useful provision contained in the original proposal.

We allude to Clause 6 in the Bill of 1904, which provided for the repeal of Sec. 1 of the Electric Lighting Act, 1888, dealing with the consent of local authorities to applications for provisional orders. In the present Bill, the question of consent is not dealt with, so that the grievance is not redressed.

The clause in the Bill of 1904 was as follows:—

> 6 (1) The Board of Trade shall, on considering whether any Provisional Order should or should not be granted, take into consideration the views of the local authorities affected on the subject, but, whether the consent of any local authority is or is not given, may grant the Order or not, at their discretion.
>
> (2) Sec. 1 of the Electric Lighting Act, 1888, is repealed from the beginning of the section down to "with such consent."

As a matter of history, we know that when Mr. Joseph Chamberlain, as President of the Board of Trade, promoted the Electric Lighting Act of 1882, he favoured the municipalities in every way, and under the right of purchase clause, crippled the industry for many years.

In 1903, under a Government which had less sympathy with municipal trading, the Bill was introduced which would have removed the grievance complained of by amending the Act of 1888, but under neither King Stork nor King Log was progress made, and we are now presented with a Bill in which that matter is ignored, the sentiment of the Board of Trade veering towards the retention by the local authorities of their privilege of obstructing the promoters of provisional orders by refusing consent to their applications.

Of course, under the existing Act the Board of Trade have the right to dispense with a local authority's consent, but the power to do so is not often exercised, and in any case the negotiations with the municipalities objecting lead to endless trouble, bargaining and expense.

The Bill now before Parliament, but which is hardly likely to weather the contingencies of the present session, contains some useful provisions, many of which have been embodied in provisional orders for some years, although not specifically included in the clauses of the Electric Lighting Acts.

The introductory memorandum to the Bill refers to the fact of the provisional orders, when granted, having to be confirmed by Parliament, and upon this point it would be useful if some provision were made for simplifying the procedure, and shortening the time, involved in obtaining the powers. In the case of a licence, the grant may be obtained within about four months, and we see no substantial reason why obtaining a provisional order should involve any longer time.

The clauses for compulsory acquisition of land for generating stations, whether situated within or without the area of supply, and for breaking up streets, &c., for connecting such works with the area of supply are useful provisions to meet the long-distance system, local stations being limited to transforming and distributing the current.

Clause 3 is another useful provision for rendering it unnecessary to apply for an Act of Parliament in order to supply in bulk, the provisional order being made available for the purpose.

Clause 5 will authorise the supply to premises outside the specified area if there are no means available for obtaining a supply otherwise on reasonable terms. This would be a common-sense arrangement, especially in the case of premises just outside the boundary of the area of supply, where it frequently happens that, under existing conditions, no supply of electricity is obtainable.

Clause 6 deals with an important element in the question of purchasing the undertaking by a local authority. It provides for the case of a generating station and mains outside the district of the municipality entitled to the powers of purchase. Under this clause, the works may be deemed to be situated within the district of the local authority.

If the station in question were supplying more than one district, of course the operation of the clause would be impossible. Take, for example, a case like that of the Crystal Palace District Electric Supply Co., Ltd., which supplied from the generating station at Sydenham parts of the districts of the local authorities of Lewisham, Lambeth, Camberwell, Croydon and Beckenham; in all these cases the right of purchase was stipulated for, but limited to the part of the undertaking within the area of each authority. Of course, only one of them (Lewisham) could have obtained the generating station, and no such power could have been exercised as is provided for under Clause 6 of the proposed Bill, but under Clause 7, the joint working of two or more local authorities could control the supply of extensive areas similar to those now being supplied by the large power companies.

It will be remembered that a few years ago an attempt was made by five local authorities to obtain an Act enabling them to carry out a joint scheme for the supply of Tottenham, Edmonton, Wood Green, Enfield and Southgate, but the scheme known as the East Middlesex Bill was defeated by polls of ratepayers taken under the Borough Funds Act, and these areas are now served by the North Metropolitan Electric Power Supply Co.

Clause 8 of the Bill makes a slight alteration with reference to the July notices under the 1882 Act, and the next Section will alter the term for revision of prices from 7 to 5 years. We doubt if there is much practical value in this provision, as the terms of supply are generally below the maximum provided for in the Provisional Orders, and applications to the Board of Trade for a revision of the charges are not likely.

Clause 14 crystallises in the Act a provision which has been inserted in all recent Provisional Orders for special terms for a "stand-by" supply. Clause 15 authorises local authorities to trade in electric fittings, and this extension of municipal trading will no doubt excite considerable opposition, especially from the trade, who will naturally resent the competition by the representatives of the ratepayers. The provision for letting out fittings on hire by local authorities will entitle them to obtain loans for the purpose, which they are now unable to do. Clause 18 is a concession to the undertakers by exempting them from stamps upon agreements with consumers. Clause 21 would be useful and prevent many objections to the grant of Provisional Orders made by County Councils controlling the public roads and bridges, as the usual clause for their protection would be dealt with under the Act. The Schedules to the Bill deal with the necessary modifications of the Land Clauses Acts, and a simplification of the regulations as to meters.

In framing the Bill the Report of the Committee on Electrical Legislation of the Institution of Electrical Engineers appears to have been ignored, and although it is not likely that the Bill will reach the Committee stage, it is as well to point out provisions necessary for meeting the case.

We have already alluded to the necessity for limiting the powers of obstruction given to local authorities, and to the shortening of the time and expense involved in obtaining a Provisional Order.

The question of the areas of supply is dealt with to some slight extent, but as the Report we have referred to points out, the "local boundaries have usually no reference whatever to the needs of the community in regard to electric supply and traction; that the selection of suitable areas should be dealt with on the basis of economic principles and industrial demands."

The memorandum prefacing the Bill refers to the Joint Committee of the two Houses of Parliament in 1898, and the Institution report urged that "effect should be given to the recommendations of that Parliamentary Committee."

The Institution Committee was of opinion that the staffs of the Government Departments concerned in dealing with the electrical industry required strengthening, so that they might be in "a position enabling them to keep in touch with all developments in engineering matters, both in this country and abroad, and that a sufficient sum should be provided annually by Government to enable them to employ and pay a proper staff for such purposes."

The Board of Trade, deservedly popular in the electrical industry for the practical and courteous way in which they conduct their business, are dealing with one of the great grievances connected with Provisional Orders, in revoking those which have been taken out without any attempt to work them, and also in making it clear that in future no orders will be granted unless there is satisfactory evidence that the applications are made with the *bona fide* intention to carry them out. In the past the way in which many powers were obtained for obstructive purposes was a scandal, and did much to retard the progress of the industry.

Another and most important question which the Government ought to deal with is that of the amendments necessary in the Tramway Act of 1870; the Light Railways Act of 1896 modified some of its worst features, but there is much more to be done in order to free this important branch of the electrical industry from the restrictions which hamper it, such as the veto of local and road authorities, the frontagers' powers of obstruction, and the limitation of tenure which has been a great obstacle to tramway enterprise.

As a practical step towards bringing about reforms in connection with Legislative enactments controlling electric supply and traction, it would be very salutary if a strong Committee of the industry were formed to act as a consultative body associated with the Board of Trade and the Local Government Board, the members of which should be selected from the technical and commercial managers of the companies, the manufacturers, and representatives of the local authorities.

But what we need is earnest definite action, and not the introduction of incomplete measures with doubtful prospects of their becoming law.

Tramway Enterprise in Turkey.

The Sublime Porte has just given an important decision in favour of private enterprise in connection with schemes for the construction of electric tramways. It appears that the local authorities of some of the suburbs of Constantinople had applied for concessions to establish tramways. The Minister of Public Works has now decided that such privileges cannot be granted to communal authorities either in Constantinople or in the provinces, as they would be lacking in both the financial and the technical capabilities for carrying out such undertakings. Nevertheless, the interests of the local authorities will be safeguarded in the agreements with those companies to which such rights will be accorded. It is expected, now that a decision has been announced, that the conferring of concessions will speedily come forward, and it is said that German firms are interested in the question. In this connection it is reported from Constantinople that a representative of two English groups of capitalists is at present staying in that city in order to secure permission to construct an electric tramway which is to connect the suburbs on the European side of the Bosphorus with the capital. The question of obtaining a concession for a line between the suburbs on the Asia Minor coast is forming the basis of competition, as recently announced, between Sir Clifton Robinson and a number of foreign financial groups, including German capitalists.

Mistakes in Tenders.

The preparation of the figures, &c., to be inserted in a tender is a matter to which considerable care must be devoted, inasmuch as a mistake once made cannot afterwards, except in exceptional circumstances, be rectified. This is because a contract is made complete by tender and acceptance. In a Scotch case, which was tried in 1900, the defendant had offered to do certain work for the plaintiff for the lump sum of £859. His offer was accepted. He afterwards found that, owing to an error made in calculation by his son, the offer was £826 less than it should have been. In an action for damages for breach of contract, the defendant contended that this mistake released him from his contract. The Court held that he was not released, the mistake having arisen through no fault of the plaintiffs', and that the plaintiffs were entitled to judgment. That this is also the law in England is shown by a very recent case, which is reported in last week's number of the *Justice of the Peace*. The case in question is Johnston *v.* Islington Union, 1909, 73 J.P., 172, in which the facts were as follows:—The plaintiff saw an advertisement in a newspaper, inviting tenders for the supply of certain goods required by a Board of Guardians. He tendered on a printed form supplied by the Guardians for the supply of a certain disinfectant manufactured by him. The tender was accompanied by a sample of the disinfectant labelled "Anite," which was delivered to an officer of the defendants. On the printed tender the defendants had asked for a tender for "Heydozone," and the plaintiff omitted to alter the word "Heydozone" into the word "Anite" on the tender, so as to make the tender agree with the label on the sample delivered. The defendants accepted the tender of the plaintiff for the supply of "Heydozone." It was held on the facts that the plaintiff had failed to show that the minds of the two contracting parties were not *ad idem*, or that the defendants had misled him in any way, and that consequently the contract was binding on him.

D

ELECTRICAL ENGINEERS AND GAS POWER.

By PHILIP W. ROBSON.

In view of the interest aroused by my contribution on "Gas Power as an Aid to the Electrical Industry," published in one of our contemporaries in December last, and the correspondence which followed its appearance, I attended the meeting of the Manchester Section of the Institution of Electrical Engineers the other night to hear the paper by Messrs. Andrews and Porter on large gas engines. My object was to gauge at first hand the feeling which the leading electrical engineers in the Manchester district had in connection with the subject. Naturally the paper in question, upon which I will touch presently, was not received without considerable criticism, but there can be no doubt that a keen and growing interest characterises the attitude of the electrical profession at the present time towards gas power for their particular work.

I passed out of the meeting with Mr. James Atkinson, one of the veterans and pioneers of the gas engine, who remarked to me that if anyone had addressed a similar meeting of electrical engineers on a similar subject three or four years ago, whilst doubtless he would have been listened to with characteristic courtesy, he would have been indulgently regarded as one of those enthusiastic one-sided engineering romancers of whom there are always a few with us, but whose statements would be described as "nothing real or practical, you know!" I think Mr. Atkinson's remark very aptly illustrates the marvellous change of feeling which has come about.

Messrs. Andrews and Porter's paper.—Of the paper itself, it struck me as an able and honest attempt to draw a comparison between steam and gas power for large stations, and the figures given were not shaken to any important extent by any of the speakers either for or against the authors' conclusions. Mr. Pearce considered the figures representing the capital cost of the steam plant to be high, but Mr. Stead, of the Westinghouse Co., had the same opinion about the figures for the gas engines, &c. So that, relatively, the authors' comparisons held good when both opinions were duly taken into account.

It was only natural, having regard to Mr. Andrews's interests in certain German-made large gas engines, that prominence should be given to them in the slides which were shown to illustrate the paper. Some of the critics seized chiefly on this fact, though their remarks were quite good-humoured, and the point they specially emphasised was that the German engines were almost exclusively operated on blast-furnace and coke-oven by-product gases, and that they might not be so successful on producer gas, which the central station engineers in this country would have to use.

Producer Gas and By-Product Gases.—Personally, I feel sure that if no difficulties of importance are experienced with large engines running on the by-product gases, there need be no apprehension in respect of them when producer gas has to be used. This view is based on the fact that the chief troubles with all large gas engines are heat troubles arising from the high temperature of the working fluid. Now, it is quite true that blast-furnace gas has a low heating value per cubic foot, and that consequently the flame temperature in the cylinder of engines operated on it is correspondingly low. It is from this point of view that blast-furnace gas is favourable to the large gas engine. The same cannot be said of coke-oven gas, however, which has a heating value approaching that of ordinary illuminating gas. The actual ascertained heating values of the three different gases under consideration are, as a matter of fact, as follows:—

1. Blast-furnace gas	...	96 to 132 B.TH.U. per cb. ft.
2. Producer gas	...	130 to 150 " " "
3. Coke-oven gas	...	400 to 450 " " "

It will be seen, therefore, that from the point of view of heat troubles (which, as pointed out, are the chief ones to be guarded against in large engines) if such engines are being successfully operated on Nos. 1 and 3, there is no reason why No. 2 should cause any special difficulty which has not hitherto been successfully met with the other gases referred to.

Are large Gas Units Advisable at the Present Time?—At the same time I am in agreement with those engineers who consider that the wisdom of adopting very large gas units *at the present time* is open to serious question, that is, for central electrical stations in this country. I think there are sound broad reasons for this view which even an ardent advocate of gas power such as I am may properly put forward without fear of being misunderstood. In the first place, there are so many competent investigators at present working on the heat problems of the internal combustion engine, especially in respect of the difficulties to be met with in large units, that we may reasonably expect some definite results from their investigations in the near future, and these results are sure to influence design. When we recall the rapid developments of the last two or three years and couple with them the further improvements to be expected over a similar period in the future, we begin to realise that at the present stage of progress in these large engines, a period of five years may make what is new to-day practically out of date in that length of time hence. The same remarks apply to gas producers. Under these circumstances, the position of an engineer who may be doing only moderately well with his present steam plant, and who yet refrains at this juncture from advising the adoption of large gas units and producers, is hardly an unreasonable one.

The Human Factor.—Then, again, gas engines and producers are in themselves so different from a steam plant that they require to be understood, and fully understood, by those who operate them if real success is to be attained. I do not for a moment consider that they are either more troublesome or more complicated, but they should be intelligently managed. Think for a moment of the class of men found amongst central station shift engineers; they have mostly been in touch with steam engines and boilers from their youth up, and in very many cases they hold duly acknowledged certificates of competency in the working and management of steam engines and boilers. Given a similarly adequate supply of practical men with equally competent knowledge and experience in the running of large gas engines and producers, I am certain that a large gas power station could be worked without a hitch. Without such a staff I would not guarantee satisfactory results. Neither steam plants nor gas plants can be properly worked without the necessary skilled supervision and attention. In this respect they are on an equal footing.

The foregoing are important reasons, sufficient in themselves to support the view which some of us hold that the very large central stations are not the places where gas power should first be introduced. In familiar similitude we should "creep before we walk," and with the design of large gas engines and producers in its present transitional stage, and also having regard to the need of gradually training up a supply of station engineers with gas-engine experience, there are powerful arguments to support the view that it is in the small and moderate-size stations that gas power should first be used.

The Economy of Moderate-size Gas Engines.—The foregoing arguments are even more apparent when we consider the comparative figures as to fuel consumption given by Messrs. Andrews and Porter, in connection with which I consider that better results might have been fairly quoted for gas-engine plants without exaggeration of their actual working economy. Neglecting the latter consideration, however, the comparison is still very favourable to gas power, even when compared with the most modern steam plants. Now, there is an important difference between gas engines and steam engines which ought never to be lost sight of, namely, in the respect that whilst the economy of steam engines falls off very rapidly as the size of the unit decreases, that of gas engines is the same for units of 100 H.P. as for those of 5,000 B.H.P. Hence the economy of gas power is much more marked in the case of small and moderate-size stations than in the large installations cited by Messrs. Andrews and Porter. Here, then, is a further argument to support the suggestion that the adoption of gas power in stations other than the very largest is the most natural preliminary step in a radical change of this character.

Low Cost of Upkeep.—I noticed that serious doubts were expressed by several of the speakers in connection with the suggestion that the cost of upkeep of the gas-engine plants

is less than that of steam plants, but there is no gainsaying the fact that all available experience points in this direction. And after all, is it so very unreasonable on due consideration that this should be so, when we remember that the only parts subjected to high pressure in a gas engine are the working cylinders? On the face of it, it would seem that those cylinders have only to be designed correctly to withstand the working temperatures and pressures, and the chief factors of uncertainty and of wear and tear are immediately removed. Speaking from personal experience of hundreds of moderate-size gas engines, to say nothing of thousands of small ones, I have certainly found that given a sound design of engine to start with, the rate of upkeep is unquestionably low compared with steam plants.

Diesel Engines.—There is another type of internal combustion engine, of which nothing was said during the discussion, but about which, I believe, we shall hear a great deal in the immediate future, and that is the Diesel oil engine. So far as internal combustion engines are concerned, it is likely to compete closely with the gas engine for central station work, and it has several important advantages which will frequently give it a special fitness for the same. This is not the occasion on which to enter into a fully detailed description of the Diesel engine, and I take it that its general characteristics are fairly well known to your readers. The following features, however, are worth emphasising :—

1. The Diesel engine is very economical both at full and at light loads, as will be seen from the following figures :—

Fuel Consumption of Diesel Engines.
(250 to 500 b.h.p. units.)

Full load ...	... 0·665 lb.	per kw.-hour ;	dynamo efficiency,	91%
Three-quarter load	0·705 lb.	,,	,, ,,	90%
Half-load ...	... 0·825 lb.	,,	,, ,,	88%
Quarter-load	... 1·150 lb.	,,	,, ,,	85%

Crude oil fuel at from 40s. to 55s. per ton.

2. There are absolutely no stand-by losses, and an engine of this type can be started up and put straight away on full load within one minute *after any length of stoppage.*

3. There are no gas plants or boilers to stoke, nor is space required for either of these ; consequently, there is great economy of space, and further, the amount of attention required whilst the Diesel plant is working is practically negligible. All that is necessary is to clean the valves every few weeks.

4. The Diesel engine works on the poorest qualities of crude oil without smell, smoke, or any nuisance whatever.

5. The range of working pressures and temperatures is no greater than in a producer gas engine. Further, the governing is absolutely perfect under all conditions of load.

Although comparatively little has been done in this country in the way of installing Diesel engines, they are being viewed with increasing favour, and the experience of electrical engineers with them is most encouraging. Six 500-h.p. engines have just been ordered by the Charing Cross Electric Supply Co., Ltd., and it is intended to install these right in the heart of the City. Abroad, however, the great Augsburg works have had somewhere near 3,000 men regularly working on the manufacture of Diesel engines for the last few years. The firms of Sulzer Bros. and Carels Frères are also largely engaged in their manufacture, so that the engine is no longer in its experimental stage. In addition to being the most perfect heat engine yet devised, it has proved in practice to be both convenient and reliable.

Within the last twelve months a splendid new works capable of employing 1,000 men has been erected at Hazel Grove, near Stockport, by Messrs. Mirrlees, Bickerton and Day, Ltd., who will be solely engaged in the manufacture of this type of engine. As this new firm are continuing the good work already done in Diesel engines by the Mirrlees Watson Co., Ltd., Glasgow, Mr. Charles Day (well known for his successful connection with the latter firm and with Messrs. Ferranti's) being the managing director of both concerns, it may be reasonably expected that their productions will meet with equal acceptance. At Glasgow the Mirrlees Watson firm have manufactured over 50 engines of the high-speed totally enclosed type in 100-kw. sets for the British Admiralty, which have been fitted in the *Dreadnought* and other modern battleships. The fuel used with these Admiralty engines is the crude oil which all these ships carry as liquid fuel for the boilers. In addition, the firm have several engines in hand for central stations.

The Influence of Internal-Combustion Engines on Distribution Problems.—Having regard to the high working economy of the gas engine in moderate sized units and of the Diesel type of engine to which I have referred, an economy which equals or closely approaches that of the very largest steam unit, it seems not unreasonable to suggest that the adoption of the former cannot fail to have a far-reaching eventual influence on the whole problem of electrical distribution. At the present time the only way of producing electricity cheaply in large cities is to have a huge plant in a central station generating high-tension current, which has to be distributed to a chain of sub-stations equipped with both stationary and rotary transformers. In each of these sub-stations a certain staff of men has, of course, to be in continual attendance.

If, however, the dynamos in these sub-stations were driven by Diesel engines, or by gas engines, either of which might be selected so as to best suit the local conditions, the present sub-station staff would be quite sufficient to work such engines, which, as already pointed out, are highly economical at all loads, and have either very low stand-by losses in the case of the gas plant, or no stand-by losses at all in the case of the Diesel engine. The result of such a system, if properly worked out, would be to eliminate the large central station altogether with its enormous capital cost, to avoid the great electrical distribution losses as between central station and sub-station, and also the cost of all high-tension transmission and tranforming apparatus. Further, the suggested arrangement would confer an elasticity for future extensions which no central-station system can possibly possess.

To put the matter in another way, the whole function of a central station is to supply current economically to the sub-stations. If, therefore, by a new system the sub-stations are enabled to produce their current as cheaply as or cheaper than by the existing means, the whole purpose of the large central station disappears.

I am quite aware that the foregoing considerations do not wholly state the problem either one way or the other ; the limits of the present article obviously make it impossible to enter into the subject fully. But I believe that the more it is examined into, the greater will be the force with which these arguments will appeal to those concerned. To my mind, they are by far the most important bearing on the internal-combustion engine at the present time in connection with the problems of electricity supply.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

West Ham "Prophets."

Recently the metropolitan world was startled by a vision of a new phœnix, the "City of Eastminster" rising out of the ashes of a much maligned electricity supply undertaking. At the same time, everyone was relieved to learn that, after the disappointing attempt of the previous year, the engineer would not again prophesy golden results. At the eleventh hour, however, that resolution has been rescinded, and "bulletins" have been issued broadcast informing the world at large that the sick patient is convalescent.

It is true that these reports are conflicting. The notice in your issue of 19th inst. is more modest and more explanatory than those of your contemporaries, although you refer to the "past" year's working instead of the current year. In other notices the net profit is stated to be 50 per cent. more than you give, but that, of course, is quite a detail. The most striking difference is in the cost per unit. Whereas you place the cost of 0·5d. per unit as "works and distribution" costs, most of your contemporaries have it that this figure represents the "total working costs," one places the figure at "under 0·55d.," and another states that 0·5d. is the "total cost including sinking fund." Now, as a differ-

ence of 0·05d. per unit on the estimated output is equal to £3,177, this apparently slight difference is all the difference in the world between profit and loss, even accepting the higher statement of 50 per cent. more than you notify. But the highest flight of imagination cannot reconcile 0·5d. "including sinking fund" with fact. This is really beyond the dreams of avarice. Imagine cent. per cent. profit, £31,771 net surplus per annum.

Your notice is modest in other respects; you congratulate Mr. Seabrook on the "satisfactory results *expected*," others on an accomplished fact, but considering the very vague and conflicting information to hand, I think it would have been wiser to withhold congratulations until the publication of the balance-sheet.

The whole of the electrical industry is interested in West Ham, where a huge financial experiment is being evolved, which, if successful, will have an important influence upon the financial operations of all similar undertakings throughout the country, and the electrical world is entitled to ask: "With what object are these guesswork figures published at this late hour of the financial year when the delay of another month would have brought forth definite results?"

Suppose from the conflicting statements we accept those which appear to be feasible, and assume, owing to the peculiar financial position in which West Ham is at present placed, that interest and sinking fund contributions have remained stationary and compare with last year's result. I have taken the stated output as correct and the income per unit at 1d. (although some of your contemporaries state it to be under) and the figure 0·55d. I have taken as the total working costs; still I fail to trace any profit.

1907-8.—*Income.*		1908-9.—*Income.*	
11,299,783 units	£58,624	15,250,000 units at 1d.	£63,542
Expenditure.		*Expenditure.*	
Working costs	33,911	Working costs at 0·55d.	34,948
Interest	16,465	Interest and sinking fund (as in 1907-8)	29,383
Sinking fund	12,918		
	£63,294		£64,331
Loss	£4,670	Loss	£789

I doubt, if even as you state, "sinking fund charges are calculated from date of expenditure," that the current year's contribution and interest can be kept lower than previous year.

Personally, I should be very pleased indeed for the good of the industry to see West Ham's experiment quite as successful as Mr. Seabrook wishes it to be, but I cannot understand the object of this premature announcement. Let Mr. Seabrook rest assured that he stands in the limelight of the electrical arena, and if he is successful or even moderately unsuccessful, his audience will not fail to appreciate his meteoric display. Meanwhile, as such a slight discrepancy as 0·05d. per unit will upset his financial calculations, I think the audience will withhold their verdict.

Curious Critic.

Polishing Commutators.

I have read with surprise the letter by "Conocimiento," and the reply by "W. P. H." under the above heading.

It seems almost incredible that an alleged engineer responsible for a station of the size mentioned by "Conocimiento" should be so ignorant of the conditions governing good commutation as to allow metal polish to be used on the commutators of his machines.

It is to be regretted that there are still men calling themselves engineers and holding comparatively important posts, who apparently think that the chief function of the commutator of a D.C. machine is to look pretty.

Surely the experience of "W. P. H." must be unfortunate if he finds "dirt and grease" on his commutators. Where does it come from anyway? One would think that the best way to cure the trouble would be to remove the cause, *i.e.*, prevent the access of grease and dirt to the commutator.

The use of metal polish must be inimical to the satisfactory running of a commutator, because it will tend to destroy the "skin" on the running surface of the brushes, and will remove that dark bronze "glaze" which characterises a well-kept commutator, and which is such an essential factor in satisfactory commutation.

My experience of metal polish (not on commutators) has been that, while it gives a beautifully clean and burnished surface just at first, this rapidly tarnishes, owing, it would seem, to some corrosive action of the polish, and I should think that this tarnished surface would be highly prejudicial on a commutator. I should also imagine that the metal polish would insinuate itself into the mica between the segments and set up corrosion, tending to cause shorts between segments and consequent "flashing over," at any rate on high-voltage machines.

As an example of good commutation, I think I may mention the plant in this station which is of 3,000 KW. capacity. The current collected off each commutator is 2,500 amperes at 220 volts; our brushes are largely composed of graphite, and have been in use without renewal for five years, during which time the only treatment the commutators have received has been an occasional wipe with a slightly oily cloth. There is never a sign of "grease or dust" on these commutators, and their colour is a delight to the eye.

In conclusion, I would suggest to the "engineer" at the station mentioned by "Conocimiento," that it would be a good idea to remove the brushes after each run and polish them with Nugget boot polish, previously digging off the "grease and dirt" accumulated on their running faces, as a result, no doubt, of the metal polish previously used on the commutator.

Chat Noir.

March 9th, 1909.

Institution of Colliery and Mining Electrical Engineers.

Owing to the numerous inquiries I have received *re* above from members of the Institution of Electrical Engineers, I must plead guilty of error in not making my letter of notice more explicit.

The rules as published in your last issue refer to working members, or rather those members who are actually in charge, or assistants of colliery or mining electrical plants.

We shall be very pleased to enrol any member of the Institution of Electrical Engineers without the restrictions of Rules 1, 2, 3 and 4.

I may also say that a monthly report will be sent to all members giving details as to the doings of the Institution, and any particulars *re* colliery plants likely to be of interest to members.

J. Williams.

Whitehaven, *March 22nd*, 1909.

British Trade with Russia.

The value of the above has lately been brought home to me in a practical manner; and in view of the admirable leader which you gave in your issue of August 28th last, I thought perhaps some of the more business-like of your readers would be glad of a knowledge of my experiences, and a hint or two on general procedure.

My company being desirous of extending their business to foreign countries, I let it be known that we would be glad to give sole agencies to one reputable firm in each country. In less than two months we received applications from five large and wealthy firms in Moscow and Petersburg, asking for particulars and terms. Three out of the five agreed to our terms, and, after making due inquiries, we wrote to one, accepting their offer. We selected this particular one, only because we came to the conclusion that they would suit our business best. They were all of equally high standing. On receipt of our letter, one of the partners immediately started for London, and spent the week with me. During that time he went into all the details necessary to give him an intimate knowledge of the working of the business, from both the commercial and technical points of view, visited the works, and generally gathered all possible information.

As a consequence, we heard from his firm about three days after his return, confirming the arrangement, ordering a complete set of samples for showroom purposes, and a further large order for goods which they had actually *sold* in the two or three days.

He assured me that Russians are extremely anxious to open up direct business relations with English manufacturers; that they will willingly pay up to 20 per cent. extra for English goods; and that now is a magnificent opportunity for my countrymen, if they will only have the small amount of common sense to see it.

I have gone into the above somewhat personal details in order to show actual proof of what he said.

I disagree with the necessity of employing a traveller, anyhow, as far as electrical manufacturers are concerned.

To my mind the best and cheapest method is to advertise that you are desirous of appointing a sole buying agent. There are many large and wealthy firms in Moscow who will readily take up English agencies on these terms. This saves the cost of a traveller and all the attendant expenses, and the agent will best know whom to trust and do business with. Instead of, as one might imagine, restricting business, it will tend to increase it, for the reason that the agent will be better able to understand the little wants and peculiarities of his own people, and will be always on the spot, which the traveller cannot be. Moreover, the sympathies of the Russian purchaser will naturally be with his own countrymen. He knows that by dealing with the agent he is getting what he wants and at the same time is helping him to get his living. It may be Chauvinism or sentiment, or whatever you like to call it, but it counts, anyhow, outside England.

As a proof of this our agent has already made an arrangement with one of the other applicants for our agency, to work together with him on mutual terms so far as we are concerned; and has sent us three orders from them. *We* tried to get them to come to this arrangement and failed.

If any of your readers are going to follow in our footsteps, they must be prepared to treat the matter seriously. They must first find their man, then ascertain his financial and technical position, and then treat him properly and handsomely. By this I mean they must trust him and give him liberal terms, both as to prices and as to payment.

I have found that the most agreeable method is to draw at two or three months for each shipment. This gives the agent time to breathe, and the manufacturer knows exactly when he will receive payment.

Packing must be very carefully attended to as the goods get rather rough handling in transit and in passing through the Customs.

Nearly all the important firms in Russia correspond in English. Our agent, who had never previously set his foot outside his own country, spoke English better than I sometimes do.

And, lastly, don't send your throw-outs or last year's stock, or anything you would be ashamed to meet a little while after.

Biz.

An Overcrowded Profession.

"Ohm Sick" and others appear extremely upset about a certain advertisement which appeared in the columns of this paper a short time ago, viz., "Young gentleman wanted," &c., and especially about the words "previous experience." Perhaps an explanation of the facts of the case, coming from one who is acquainted with them, would not be out of place. The facts are briefly these :—There is in a certain station a vacancy for a pupil. A school-boy is evidently not wanted —hence the statement "previous experience." What is meant by this is one who has had two or three years in the shops, and knows the difference between a crosshead and a commutator, and who will not pull out switches just to see fireworks.

The training of this prospective "chief assistant" consists of teaching him to look after the plant in an intelligent manner, and to make him capable of taking a shift, or running the station in the absence of the chief, in fact, to be the assistant to the resident engineer. The particular station is only a small one, and the pupil would hardly expect to be at once the chief assistant in a station of 50,000 KW., but having had a fair amount of responsibility and the charge of men, he would undoubtedly be more self-reliant than one of many in a large station.

To quote "Bus-bar" in the issue of March 19th :—"'Layman' and 'Amonyd,' who practically agree with companies in paying low salaries (?) to, in some cases, really good men, who have been well trained, and at great expense," I imagine that these "really good men" would have sufficient acumen to see they were not referred to in anyway in the particular advertisements which form the basis of "Ohm Sick's" wild outpourings.

If "Ohm Sick" finds himself a failure, then it seems to me there must be a radical fault in his expensive system of training, and it would appear to be a waste of money.

S. Hunt.

March 20th, 1909.

It is difficult to see quite what "Ohm Sick's" bone of contention is. He states that for his outlay of £700 he received a thorough training, and did not enter the profession by the back door—whatever that may mean.

Presumably, he spent some of his time in a central station; if so, did he pay for this part of his training, and if so, why object to others doing the same?

It would be interesting to know whether "Ohm Sick" takes premiums from pupils who have had some slight previous experience, and by training them, saves his lighting station anything per annum, or whether he trains them from a philanthropical standpoint. If the former, and if he does not save the station anything, then I would never advise any young man to go to his station, as it is evident he would be only a looker-on and not an actual worker; if this were not the case, then "Ohm Sick's" testimonial of himself is not correct when he states he is fit for, and capable of, taking charge of large works with credit to himself and his employers, for his works then would be over-staffed.

Amonyd.

[This correspondence is now closed.—Eds. E.R.]

Supply by Meter, or Contract?

In the course of the article on the above subject, which appeared in your issue of 5th inst., I discussed briefly the type of meter suitable for small consumers. The question of the large consumer is dismissed in the first sentence. I was therefore only dealing with the mercury type of ampere-hour meter from the standpoint of the supplying of these small consumers, and not indulging in "generalities." My only concern is that every unit supplied should be registered, and it is quite immaterial whose meter is used for the purpose. What all supply authorities want is a meter that will register to within 2 per cent. from the lowest practical load to the highest load. As such a meter does not exist, they must rely on their responsible employés' choosing the most perfect meter to suit each individual case. Undoubtedly the financial results of an undertaking can be considerably improved by strict attention to this point. Take a recent case as an example. A meter was required for a small shop with one Osram lamp in a dark room at the back. The all-day load would be 0·24 ampere, the evening load 1·5 amperes. The records of two dozen of the most modern mercury type 5-ampere meters were looked up, and the average percentage slow at 0·28 ampere was 10 per cent. A 5-ampere electrolytic meter was fixed. With reference to "J.C.L.V.'s," letter of the 19th inst., I am quite aware of the disadvantages of the electrolytic type that he refers to. I have never come across one of these meters whose reading was difficult to obtain owing to scum. By taking the simple precautions necessary scum should never form. With his concluding remarks I quite agree.

The capacity of the meter referred to in the article was 5 amperes, and it had been in use for two years. On bringing in it was found to be within 2 per cent. at 4 amperes and 83·8 per cent. slow at 0·24 ampere, both tests being dial tests. My statements, therefore, that the revenue from this consumer was trebled or quadrupled by changing the meter is proved to be correct.

Regarding "Unonot's" remarks, most readers with meter experience will acknowledge he has chosen a very fitting *nom de plume* for himself. I have yet to learn that it is possible for a mercury type meter to be 400 per cent

slow. A meter registering a quarter of what it should do would have its registered units quadrupled by making it correct. As regards the general argument of charge by contract or meter, the former method has *not* had an extensive trial in this country to my knowledge.

As regards "the rather feeble" suggestion to give only a daylight supply to these very small users when charged by contract, the Guildford Electric Supply Co. are doing this, and it would be interesting to hear as to its success. In conjunction with the street lighting of the district supplied in this manner I think the idea fairly good, but, of course, opinions differ.

W. A. Toppin.

Surely "Unonot" is wrong when he writes, the "meter must obviously have been 300 per cent. or 400 per cent. slow." I have always understood that a meter must have ceased registering when it is 100 per cent. slow; beyond this, the reading must be negative. Presumably, he means that the one meter was 300 or 400 per cent. *faster* than the other. Supposing the electrolytic meter was correct, and gave a reading 400 per cent. higher than the motor meter, then the latter must have been 80 per cent. slow.

C. N.

Cardiff, *March 22nd*, 1909.

["Unonot" has also written to point out this accidental inversion, his intention having been to say that the electrolytic meter was 300 or 400 per cent. faster than the motor meter.—Eds. E.R.]

LEGAL.

Pharo *v.* the London United Tramways Co.

In the King's Bench Division last week Mr. Justice Coleridge and a common jury heard this action, by which the plaintiff claimed damages for an accident alleged to have been caused by the negligence of the defendant company.

The plaintiff resided at Esher, and carried on business in the Borough Road as an electrical and general engineer, lamp manufacturer, &c., and while cycling home on a night in July, 1908, was thrown from his machine through the wheel of his bicycle catching in the tramlines. The accident occurred at the junction of the Brighton and Portsmouth Roads, near Surbiton, and the plaintiff attributed it to the widening of the rails through use. It was said that the statutory width of the groove should be 1½ in., but at the point in question it must have been considerably wider, as the width of the tire of the plaintiff's machine was over 2 in. He claimed the amount of fees he had paid to medical men, £5 per week for 10 weeks, the period of his absence from business, £75 in respect of a contract for heating schools, which he said he had lost through it, and general loss of profits. A sum of £250 was originally claimed for loss of an agency for high-pressure lamps, but that was abandoned.

The plaintiff gave evidence in support of his case, and in cross-examination, said that he carried on business in partnership with his son, and employed a manager and a number of workmen. He did not know what was the average life of a tramway rail, nor that the particular rail in question was laid in 1906, and consequently the accident had happened within two years of its being passed by the Board of Trade.

For the defendant company it was argued that they were not liable, and that there had been contributory negligence on the part of the plaintiff.

In the result the jury found a verdict for the plaintiff for £175, and judgment was entered for that amount. Stay of execution was, however, granted pending an appeal.

Krieger Electric Carriage Syndicate, Ltd., and Reduced.

In the Chancery Division, on Saturday last, Mr. Justice Parker heard a petition by this company for the sanction of the Court to a reduction of its capital.

Mr. Mark Romer, K.C., who, with Mr. Wright, appeared in support of the petition, stated that the company was incorporated in 1903 to carry on the business of manufacturers and dealers in motor-cars, but its chief business had been to let out on hire motor-cars that it had either manufactured or acquired. The original capital of the company was £30,000, divided into 3,000 shares of £10 each; but by a resolution passed in accordance with the articles of association, the capital was increased to £100,000 by the issue of a further 7,000 shares of £10 each. By a subsequent resolution the whole of the £100,000 capital was divided into shares of £1 each, and of these, 55,500 had been issued, 46,590 being paid for in cash, and 8,910 being issued as fully paid up. The company had power by its articles to do everything it had done, and it had also power to reduce its capital. Resolutions were duly passed and confirmed in December, 1908, and January, 1909, for a reduction of the capital by a sum of £27,750, the company having lost assets to over that amount. It was proposed to effect that reduction by reducing the 55,500 issued shares from £1 to 10s. each, leaving the 44,500 unissued shares at £1 each. The new capital of the company would therefore be £72,250, divided into 55,500 shares of 10s. each and 44,500 unissued shares of £1 each. Capital had been lost to the tune of over £28,000, which was accounted for by loss on cars (which, as his Lordship would understand, being let out on hire, depreciated in value), loss on batteries, and loss on shares held by the company. With regard to the last item, the company had thought it advisable to hold shares in a battery company, and had bought shares which were not now worth the amount originally paid for them. The company also held patents dated 1896, 1897 and 1899, and as they were running out and other patents had come into existence, the value was not now what it stood at in the company's books. There was also a small loss from leases of property owned by the company running out.

Having heard the evidence in support of the petition, his Lordship sanctioned the reduction as proposed, and directed the words "and reduced" to be used as part of the company's title for one month.

"Z" Lamp Manufacturing Co. *v.* Zossenheim.

The motion by the plaintiffs in this action, for an interim injunction to restrain an alleged infringement by the defendant of their patent for electric lamps, was again before Mr. Justice Parker in the Chancery Division last week.

Mr. Colefax, who represented the plaintiffs, reminded his Lordship that the matter had already stood over on two previous occasions, and the object was to file any evidence he intended to use by the previous Tuesday. No evidence had been filed, though at the time the writ was served the defendant was also served with the evidence the plaintiffs intended to use on the motion. The defendant admitted that he was selling the lamps alleged to be an infringement, but said that he was selling them as agent for a company abroad.

Counsel for the defendant said that he had not yet been able to get evidence from the company abroad, and he asked for a further week's adjournment. Of course, if no evidence was then forthcoming, he must take the consequences; but he was naturally not willing to take upon himself serious litigation in respect of goods for which he was merely an agent.

Mr. Colefax said that if the motion again stood over, the defendant should give an undertaking not to go on selling the lamps in the meantime.

Counsel for the defendant said that would have the effect of stopping his business, but under the circumstances he did not see how he could resist giving the undertaking if it was pressed for.

The motion accordingly, on the defendant's undertaking, stood over for another week.

Salford Corporation *v.* Duncan Carmichael & Co.

Plaintiff Corporation claimed £3 14s. from defendants, a firm of contractors and general repairers, for damage done to their cables in March last while one of defendants' labourers was employed digging a trench in St. Luke's school-yard, in Eccles New Road. The judge said he considered that the Corporation had been negligent in putting the cables over the drain instead of under it, and he could find no negligence on the part of the defendants. So far from the Corporation suing the contractors, they ought to consider themselves lucky that they did not find themselves open to a serious action for negligence. He gave judgment for the defendants, with costs on the B scale.

Johannesburg Municipal Council *v.* D. Stewart & Co. (1902), Ltd., and Others.

In the Court of Session at Glasgow last week, before the Lord President and Lords M'Laren, Kinnear and Pearson (according to the report in the *Glasgow Daily Herald* which we quote), there was disposed of a reclaiming note against an interlocutor of Lord Mackenzie in an action at the instance of the Municipal Council of Johannesburg against D. Stewart & Co. (1902), Ltd., Glasgow, and William Beardmore, shipbuilder, Glasgow, and the representatives of the late Joseph Beardmore, Glasgow, claiming sums amounting to over £400,000 in respect of the defenders, Stewart & Co., Ltd., having abandoned and failed to implement contracts entered into by them with the pursuers for the installation of gas-producing plant, gas engines and electrical plant for the city of Johannesburg for tramways, lighting and power purposes. The defenders, Stewart & Co., plead that the matter should be dealt with by arbitration, and also that, in terms of their contract, the matter should be decided by English law and in England. They deny the breach of contract, and aver that the installation was made according to the specification of the pursuers, and that any failure of the installation to reach the prescribed tests was due to unsuitability of coal supplied by the pursuers to the defenders, Stewart and Co., for gas-producing purposes. The defenders, Beardmore, were guarantors for the performance of the contract by the other defenders, their liability being limited to the amount contained in

a bond—viz, £115,234. The balance of the sum sued for is £145,000 for repayment of the part of the purchase price already paid to Stewart & Co., and about £200,000 for damages for breach of contract.

Lord Mackenzie in the Outer House dismissed the action in so far as it was directed against Mrs. Beardmore. His Lordship found that the arbitration clause founded on by the defenders fell to be construed by the law of England, and before further answer sisted procedure *hoc statu* in order that the parties might carry through arbitration proceedings in England, if on a true construction of the clause it was valid and covered the dispute in question. His Lordship also sisted the action so far as directed against the defender, William Beardmore.

The Court decided to recall the interlocutor of the Lord Ordinary, and find that there should be a case stated for the determination of the English Court to see whether the arbitration clause in question was valid and covered the question in dispute. The action as against the Beardmores was dismissed, the question of the liability of the guarantors not arising until that of the principals had been determined.

Bosch *v.* Simms Manufacturing Co., and Another.

In the Chancery Division on Friday, March 19th, this action came before Mr. Justice Swinfen Eady upon a motion by Robert Bosch, electrical engineer, of Stuttgart, and head of the well-known firm, the Bosch Magneto Co., of Stuttgart, London, &c., against the Simms Manufacturing Co. and the Simms Magneto Co., the selling agents, for relief in respect of an alleged breach of an injunction granted against them in respect of the sale of magnetos. Plaintiff applied for a writ of sequestration against the defendants in consequence of such breach. There was a second action by the same plaintiff for leave to issue a writ of sequestration against the Simms Manufacturing Co., Ltd. (a new company), for wilfully disobeying the order and aiding and abetting the old company in disobeying and setting at defiance the order.

Mr. Gore Browne, K.C., who appeared for the plaintiff, stated that up to February, 1905, plaintiff had been joint owner with the Simms Manufacturing Co., of the patent rights of a certain magneto, and they carried on business together in the sale of this patent under an agreement which determined the relationship between them. On February 5th, 1907, however, the Simms Manufacturing Co. agreed to sell to Mr. Robert Bosch the patent rights and the goodwill of the magneto business generally, with the benefit of all order books, &c., for the sum of £20,000. This was done, and Mr. Bosch contemporaneously agreed to grant to the Simms Manufacturing Co. a licence to manufacture magnetos in accordance with the patents upon certain terms arranged between the parties, one of which was that the defendant company must not solicit the customers, by letter or by travellers, of what had been the joint partnership. In June, 1907, Mr. Robert Bosch obtained a perpetual injunction against the Simms Manufacturing Co. for breach of this agreement, and in September of the same year the Simms Manufacturing Co. went into voluntary liquidation, and a new company of the same name was registered on October 3rd, 1907. The Simms Magneto Co. continued to act as selling agents to this new company. A Mr. Alltree, who was manager and sole traveller to both the new and old companies, and also to the Simms Magneto Co., called upon the Rex Motor Cycle Co., one of plaintiff's customers, and solicited from them an order for magnetos and sparking plugs. Mr. Alltree saw a Mr. Jones, buyer for the Rex Co., and also that company's managing director, Mr. Williamson, who expressed their inability to do business with him that day. Shortly after Mr. Alltree wrote to the Rex Co., asking them to send his firm a small order for their goods, that they might satisfy themselves of the merits of the Simms magnetos, and at the same time he quoted lower prices for similar machines to those already being supplied by the plaintiff's company. Plaintiff contended that this was a breach of the injunction, inasmuch as the new Simms Manufacturing Co., Ltd., was one and the same with the old Simms Manufacturing Co. The directors were the same, and so also were the shareholders, and the company had simply been formed for the express purpose of evading the injunction which had been made against the old company.

Mr. Russell, K.C., who represented the defendants, denied that the Simms Manufacturing Co., Ltd., was not a *bona fide* company, and separate for all purposes from the old Simms Manufacturing Co. He submitted that no injunction had been made against this company, to whom the right of selling the Simms magnetos had been assigned. He further denied that Mr. Alltree solicited custom when he called at the offices of the Rex Co., but whilst there with regard to the sale of sparking plugs, the Rex representative asked Mr. Alltree to quote prices with regard to the Simms magnetos, which he did, but received no order. Defendants contended that, in view of these inquiries by the Rex Co., Mr. Alltree was justified in writing to them afterwards, asking them to take a small number of their machines for testing, with a view to a larger order. Mr. Alltree had not solicited their custom, inasmuch as the first inquiry came from the Rex Co.

Affidavits were read, and witnesses called for both sides.

His Lordship, in giving judgment, held that Mr. Alltree did call upon the Rex Co. for the purpose of soliciting orders for magnetos, and that the letter which was written by him afterwards was also written for the purpose of obtaining custom. The new company was a reconstruction of the old company, but in his opinion it was a genuine reconstruction, and it was not made simply for the purpose of evading the order of the Court made against the old company. It was a reconstruction for the purpose of obtaining additional capital. There was no injunction against the new company, and they were not in any way the servants or agents of the old company. The solicitation by Mr. Alltree was on behalf of the new company, and that did not constitute a breach of the injunction. He, therefore, would make no order on the motions, and each side must pay their own costs.

Re The Electro-Peat Coal Co., Ltd.

(*Continued from page* 471.)

When this case was resumed on the 17th inst., Col. St. Quintin, in further cross-examination, said he had had seven "A" shares in the syndicate, given him by Mr. Simpson for work he had done on behalf of the company. Those shares were subsequently changed for 99 ordinary shares, and they were then put in his name. He did not know what became of the original report of Mr. Scoones. Witness busied himself with the actual value of the peat coal itself, leaving the other company matters to the officials. He never authorised the prospectus to be shown to anyone for underwriting purposes.

Mr. F. Howard Allen, of Bowdon, Chester (the last of the defendant directors), said he lived in a peat district, and was much interested in the question of peat fuel. After giving some of the peat coal to experts and getting a favourable report, he consented to become a director. He never authorised the prospectus of January 20th to be shown to anyone for the purpose of getting shares underwritten. He did not underwrite shares, or take any part in the promotion of the company. He had every reason to believe that the statements in the final prospectus were correct.

In cross-examination, Witness admitted that he signed the prospectus without making special inquiries whether the statements in it were correct. He left that matter to the officials of the company. He had no idea that Mr. Scoones's report had been modified as to the calories of peat coal, and he signed the prospectus without knowing of the alteration.

In reply to Sir E. Carson, who said he had only one or two short witnesses to complete the case,

His Lordship said he should leave to the jury the question raised in the pleadings.

On Thursday, March 19th, Capt. Jas. C. Verey, the engineer who was in charge of the works at Kilberry, was called. He said he had been engaged in general mining for 30 years in various countries. Towards the end of 1903 Mr. Bessey brought his process to witness's attention, and he made various tests of it in his own laboratory. The main difficulty in dealing with peat was the great amount of moisture which it contained. The great advantages which the peat coal possessed over ordinary coal were its freedom from sulphur, the little clinker it made, and the little smoke produced. It was also better than coal for packing, as a ton of peat coal would pack in 29 to 31 cb. ft. of space, whereas a ton of coal required 45 ft. As to its value for household purposes, he had burned some 250 tons of it, and he would not wish for a better fuel. A peat-coal fire made up in an ordinary sitting-room grate at 10 or 11 at night, would be red-hot and radiating heat in the morning. He had tested peat coal for heating water as compared with ordinary coal, and he found that the former raised steam quicker. He was resident engineer at Kilberry till the machinery was taken away. He had sold 5 tons of peat coal to Col. Spottiswoode at Cork at 5s. per ton, but that was because it was frosted. The cost of sun-dried or half-dried peat was 12s. to 18s. per ton. He thought 9s. per ton for peat coal was much too low, considering its value. They never got less than 15s. per ton for what they made, and he had had hundreds of letters asking for it. Capt. Gibson, of Limerick, offered the company £1 per ton for all they had in the works, but witness would not sell it, as what they had was frosted, and he did not think it in the company's interest to sell damaged output. He thought the cost of production at 5s. was reasonable, but he had worked some out at 2s. 3½d. per ton, not allowing for establishment expenses. The company had practically 2,000 acres of peat land to deal with, and their rent for the works included this land. The process, he believed, was a valuable one, but it wanted money to develop it. Asked how it was that the frost attacked it, he said there was a certain amount of moisture in peat which was freed in Bessey's process, and this water, if frozen, expanded in the same way that it did in the soil. That occurred sometimes in the process of drying after the peat had been treated by the process. When once it had been dried properly the frost would not affect it. Unfortunately, almost all they had made was made in cold weather.

Cross-examined: His opinion was that the company failed for want of capital. He was not now in the company's employ, and they owed him money. He could make 10 tons an hour with the machinery he had at Kilberry. There was a very large sale of peat in that neighbourhood, but the labour of getting peat for the company was nothing compared with that of the labourer who cut it one turf at a time, whereas the company dropped a "grab" in the turf and picked out a ton at once. The electric process shortened the drying period because the water was free to evaporate. There was some 20 per cent. of water in the peat coal, but it would burn equally well with 30 per cent.

Re-examined: There were 2,000 acres of peat land included in what the company paid rent for. There were 200 tons of peat in every acre a foot down from the surface, and he had made soundings to find out the depth of the peat in 40 places, and found the average depth was 26 ft. 6 in.

Mr. K. D. Houston, solicitor to the company, gave evidence as to finding Scoones's report among the papers.

His Lordship asked if Mr. Darlington Simpson was in court, and no reply was made.

Counsel then discussed the question of the manner in which the issues were to be left to the jury and the questions to be put to them; and eventually his Lordship said he should leave to the jury all the questions raised in the pleadings, but he could not say what form they would take till after consideration.

Sir E. Carson then began his address to the jury, and the hearing was adjourned to Monday.

On Monday counsel representing the various defendants addressed the jury.

Mr. Atkin, K.C., for Mr. Macgregor, said after the commencing speech of Sir E. Carson for Lord Mayo, he would not touch on anything that was common to all the defendants, but he wished to represent to the jury that the case was of the utmost importance to Mr. Macgregor. He was not a man of title or wealth, and his resources in fighting this case had been strained almost to breaking point. He was a commercial man at the present moment, enjoying an important position in the firm of Johnson and Phillips, and his commercial character was his character. One of the greatest peculiarities of the case was that no one alleged that any of the defendants had made money out of the concern, and in the case of Mr. Macgregor, the facts were stronger than in the case of any of the other defendants. He went to the company as the representative of Messrs. Johnson & Phillips, and the result of his connection with the company had been that his firm had made a loss of £9,000 over the business, while Mr. Macgregor, out of his own savings, had lost £200, money that he himself put into the company because he believed in it and was trying to pull it round. The suggestion that he was trying to defraud the public in order that his firm might have the benefit of the work from the company was absurd and ridiculous. The onus of showing that there was fraud on the part of the directors, he submitted, was thrown on the plaintiff. The jury could not guess at it. Fraud must be proved by clear and cogent and convincing evidence—it must be proved without the shadow of a doubt that the defendants authorised the issue of the prospectus of January, and that they knew it contained statements which were not true, and that he contended the plaintiff had signally failed to prove. Mr. Macgregor had not put one penny in his pocket out of the company—his firm had lost £9,000 out of it, and the jury were asked to brand a man like that as a fraudulent director in the company. It was with the very greatest confidence that he left the issue with the jury.

Mr. Isaacs replied at great length for the plaintiff, submitting that the whole of the evidence now heard, and the documents which had been disclosed in the case, gave strength to the case made out by the plaintiff. He said that the directors had shown the most cynical disregard of the ordinary duties and responsibilities of directors, and when put to the question in the witness-box all tried to throw the responsibility on Mr. Fox, the solicitor, and Mr. Kelly, the secretary, neither of whom had been called in evidence. The defendants had acted with reckless disregard of their duty, and had made no proper sort of inquiry into the statements they authorised in the prospectus, and they must be held responsible for the result.

On Wednesday, his Lordship occupied practically the whole day in summing up. He left a number of points to the jury.

The jury, after about two hours' deliberation, found as follows:—That Darlington Simpson was a promoter of the company; that the directors did not, but that Simpson did, authorise the draft prospectus of January 20th to be shown to underwriters; that the statements in the prospectus were untrue to the knowledge of Simpson, and that plaintiff was induced by these statements to take shares; that the statements in the second prospectus were untrue to the knowledge of Simpson; that the directors and promoters had not reasonable ground for believing the statements to be true; that the statements in the April prospectus were untrue, but that plaintiff was not induced thereby to take shares in the company; that the facts were concealed from the plaintiff, but the jury did not believe with fraudulent intent; that the plaintiff did not know the facts and statements were untrue before April, 1906; that there was no evidence that Scoones's report on the prospectus was a fair and correct copy, and that the directors had reasonable ground for believing that Scoones was competent to make such a report.

His Lordship had left the building, so that the findings, with respect to their legal effect as to judgment, were left to be discussed on Thursday.

Cowans, Ltd.

Mr. Justice Swinfen Eady on Tuesday, March 23rd, in the Chancery Division of the High Court of Justice, sanctioned the reduction of the capital of Cowans, Ltd., electrical engineers, from £30,000 to £24,520, by writing off capital which had been lost or was unrepresented by available assets, by returning capital in excess of the wants of the company, and by extinguishing liabilities on the preference shares. The company was formed in 1898 with a capital of £30,000, divided into 2,000 preference shares of £5 each, and 4,000 ordinary shares of £5 each.

Fraser v. Hughes & Stirling.

In the King's Bench Division on Tuesday, Mr. Justice Hamilton delivered judgment in this case, which occupied the Court during four and a-half days.

Mr. Hollis Walker and Mr. Dyer were for the plaintiff, and Mr. Colefax with Mr. Ball appeared for the defendants.

The plaintiff's claim was for damages for breach of contract and the return of money paid on a consideration which had failed. By an agreement in writing, dated October 28th, 1907, between the plaintiff and the defendants, the latter agreed to execute for the plaintiff certain works, comprising a destructor and destructor buildings with contingent works, at Hayes End, in Middlesex. The guarantee on the part of the defendants included a 4-cell plant, which should be capable of burning from 60 to 70 tons of ordinary house refuse per day; and that the plant should only require three men per shift to do the entire work. It was further guaranteed that the furnaces would be capable of raising as much steam per day as had previously been raised by burning coal at the rate of 5 cwt. per hour.

A large number of witnesses were called, the evidence given being chiefly of a technical character in relation to materials used, method of construction, and results accomplished.

His Lordship delivered a lengthy judgment, stating that the conclusions at which he had arrived were, in the first instance, that the plant was not completed within the specified time, and that when completed it was not capable of doing its work, even after an opportunity had been given for amendment. He gave judgment for the return of the money paid and certain other items, making in all £1,587, with costs. On a counterclaim raised by the defendants, he also gave judgment for the plaintiff.

Judgment accordingly.

BUSINESS NOTES.

"Phœnix" Business.—Among the orders secured by the Phœnix Dynamo Manufacturing Co., Ltd., during the last two months are the following:—

Large flax mill in Belfast.—Forty-two three-phase motors averaging 10 H.P. each.

Cape Town Corporation.—100-KW. motor-booster and switchboard.

Cardiff Corporation.—Two 300-KW. D.C. to single-phase motor-generator sets.

Birmingham Corporation.—Motor contract, comprising 240 motors, varying from ½ H.P. to 50 H.P. in size.

Firm of cocoa manufacturers.—Slow-speed generator for coupling to gas engine, output being 368 KW. at 160 R.P.M., and motors.

Large gas engine firm.—Slow-speed generator for coupling to gas engine for their works plant; output 160 KW. at 150 R.P.M.

Liverpool Corporation, Darlington Corporation, and local electric lighting companies in South Wales and Herefordshire.—Various motors, generators and boosters.

Birmingham University and Manchester and Dewsbury Technical Colleges.—Plant consisting of special motor-alternators, boosters and transformers.

Textile mills, engineering works, &c., in the Lancashire and Yorkshire district.—Three-phase D.C. generators and motors.

In addition to the above, they are completing the manufacture of a direct-current turbo-generator of 600-KW., and four special motors, each of 250 H.P., for a concern in the North. The company report that January and February were very good months with them for orders, and that they have over 400 machines on order at the present moment, having a total horse-power of considerably over 10,000. They are commencing an extension of their works, and have recently placed orders for more machinery to enable them to cope with increased business.

Meter Approved.—The *London Gazette* for March 19th contains notice by the Board of Trade approving the Hookham meter 1907 type, deposited by Messrs. Chamberlain and Hookham, Ltd.

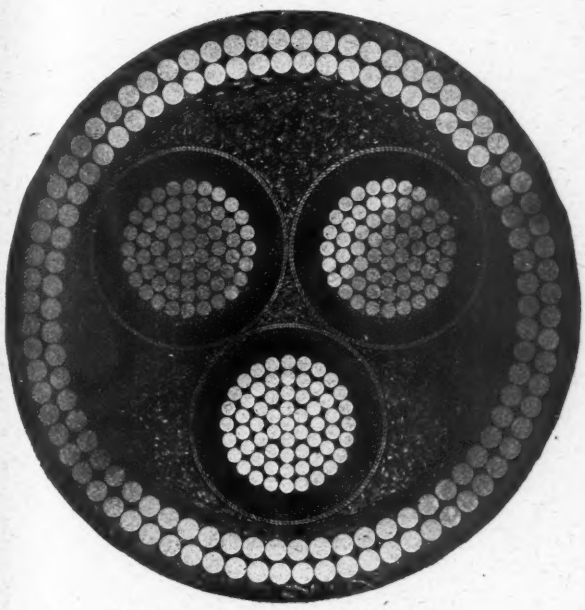
Diploma.—For their exhibit of arc lamps and motors at the Sheffield Smoke Abatement Exhibition, the Union Electric Co., Ltd., have been awarded the first-class diploma for trade and municipal appliances.

Arc Lamp Gear.—The London Electric Firm, of Croydon, have recently booked a large number of repeat orders for their "One Working Part" arc lamp lowering gear and self-sustaining winches. A list of these, which is before us, includes about 1,000 sets for the Westminster Electric Supply Corporation, Ltd., a similar quantity for various Government Dockyards, 200 sets for the L.C.C., and many other smaller contracts for Borough Councils, railway and other authorities.

Tramcar Lifeguards.—Messrs. Hudson & Bowring, Ltd., inform us that following the success of the lifeguard trials in New York, they have received contracts for the fitting of the whole of the cars of the Second and Third Avenue systems in New York, and many other orders, to the extent of 4,000 guards.

Twinob Switch.—An ingenious switch for starting single-phase motors has been put on the market by Messrs. A. P. Lundberg & Sons, 477, Liverpool Road, N. Many such motors are provided with a special winding, which is thrown into circuit only at starting, to produce a rotating field; when the rotor is up to speed, this winding is cut out. The inventor has constructed a tumbler switch similar to the double-knob switch which we recently described, but has so arranged it that one of the switches will not stay on unless held. Thus, in starting, both dollies are pushed over, but directly the motor is running and the knobs are released one switch comes off, disconnecting the special starting winding. This is an excellent and extremely convenient device.

A Large Colliery Cable.—We illustrate herewith another large colliery cable, recently manufactured by Messrs. W. T. Henley's Telegraph Works Co., Ltd., of Blomfield Street, London, E.C., who are specialists in the manufacture of mining cables. It is of the three-core type, for transmitting three-phase current down the shaft of a mine at a pressure of 500 volts, each conductor being of ·4 sq. in. section, composed of 61 tinned copper wires, each ·092 in. in diameter, insulated with vulcanised bitumen to a diameter of 1·168 in., making a total thickness of insulation between cores of ·340 in. and between any one conductor and earth of ·170 in., covered spirally with two lappings of taping, the three cores then laid round a centre with wormings, again taped, heavily braided and compound armoured with two layers of galvanised



Large Colliery Cable by Henley's.

iron wires, each wire ·128 in. in diameter, served overall with tarred yarn and waterproof compounded to a diameter of 3½ in., the breaking strain of the completed cable being 50 tons. The cable was manufactured and delivered in one length of 380 yards for suspension down one of the shafts of the Deckmont Colliery, owned by Messrs. A. Russell & Co., Ltd., to the order of Messrs. G. Harland Bowden & Co., of Manchester and Glasgow. The drum used for the delivery of the cable from Messrs. Henley's works to the pit mouth measured 9 ft. high by 5 ft. 6 in. wide, and the total gross weight, including the cable, was 8½ tons.

Steam Pipework Dimensions.—Messrs. Foster Bros., Ltd., of Lea Brook Works, Wednesbury, have just issued a hanging card list giving dimensions, thicknesses, &c., of flanges, pipe, branches, bends, valves, separators, &c., for main steam pipework installations. The form is convenient for drawing-office use, and an effort has been made to embody the general information required by engineers when designing pipe ranges. Any works engineer can obtain a copy on application to the firm.

Book Notices.—"Electrical Installations." By R. Kennedy. Vol. 3. London: Caxton Publishing Co. 1909. Price 7s. 6d. net per vol.

"Lightning and the Churches." By A. Hands. London: J. W. Gray & Son. 1909. Price 1s. net.

"Fire Tests with Doors. Set of two 'Wilson' Steel Rolling Shutter Doors." Red Books of the British Fire Prevention Committee, No. 135. London: The Committee. 1909. Price 2s. 6d.

"Report of the Board of Education, 1907-8." London: Eyre and Spottiswoode, Ltd. 1909. Price 7d.

"American Society of Civil Engineers. Constitution and List of Members." February, 1909. New York: From the Society.

"Clarkson Bulletin," January, 1909. Potsdam, N.Y.: Clarkson School of Technology.

"School of Mines Quarterly." January, 1909. New York: Columbia University. Price 50 c.

Tantalum Lamps.—The Siemens & Halske Co., of Berlin, announces that tantalum lamps of 32 and 50 c.p. for pressures of from 200 to 240 volts are now being manufactured. It is said that the new lamps have already stood the test well at these voltages in practice, and have an efficiency of 1·5 watts per Hefner candle.

Trade Announcements.—The Titan Lift and Electric Co. are now settled in their new premises at 113, Clerkenwell Road, E.C.

Messrs. Siemens Bros. Dynamo Works, Ltd., will, on Friday, April 2nd, remove their incandescent lamp and fittings department to larger premises at Tyssen Street, Dalston, N., to cope more effectively with increased business. All communications referring to the above matters, previously addressed to 6, Bath Street, City Road, E.C., should, after the date named, be sent to the new address.

The Globe Electrical Co. has been formed, and is about to be registered, with offices at 11, Farringdon Avenue, E.C., to carry on the business of the Santoni Arc Lamp and Engineering Co., Ltd. All the assets, including the stock-in-trade, of the old company, have been acquired.

Bankruptcy Proceedings.—Robert Russell (trading as R. Russell & Co.), Putney, electrical engineer.—The public examination took place at the Wandsworth Bankruptcy Court on March 18th. Examined by Mr. Knight, Deputy Official Receiver, debtor said he closed about December last because he had no means to continue longer. His failure was due to his losing an action in the action in the High Court, brought by Messrs. Geipel & Lange, for goods supplied. Debtor's defence was that the goods were not up to standard, and plaintiffs' contention was that he bought them as a job lot, and knew it. This latter view was accepted by the jury. He first knew he could not pay his debts in full at the time of the action. He had paid his solicitor £120 for costs in the action. The examination was adjourned.

Bridgewater & Wright, electrical engineers, 78, York Road, King's Cross.—A receiving order was made on March 16th on a creditor's petition. The first meeting and public examination will take place on April 2nd and 28th respectively, at Carey Street.

Dissolutions and Liquidations.—Generators, Ltd.—A meeting of creditors of this company, which is in voluntary liquidation, was to be held at the office of the liquidator, G. B. Murgatroyd, Duchy Chambers, Clarence Street, Manchester, on March 24th.

Municipal Electric Light and Power Corporation, Ltd.—A meeting is to be held at 37-39, Essex Street, Strand, W.C., on April 20th, to hear an account of the winding up from the liquidator, Mr. E. G. W. Slough.

Empire Electric Light and Power Co., Ltd.—A final dividend of 1s. in the £ is payable on April 3rd, at the office of the liquidator, 5, Lime Street, E.C.

LIGHTING and POWER NOTES.

British Columbia.—The British Columbia Electric Co., before developing its Jordan River power proposition, is seeking an agreement with the Victoria city authorities on lines similar to those of last year. From the mails to hand, it appears that the proposal is that the city is to go on with its application to deal in power and light, at the same time inserting a provision by which the city, should it choose to exercise this power, shall first offer to buy out the company. In event of this provision being accepted the company will erect a power plant of not less than 10,000 h.p., and will make extensions of the electric railway, light and power systems at a cost of $750,000. The company's expenditure at Jordan River is estimated at $1,250,000, in addition to the foregoing.

Canada.—The Ontario Hydro-Electric Power Commission's transmission scheme, the contract for which has been let to Mr. F. H. McGuigan, of Toronto, includes some 300 miles of 110,000-volt transmissions, with an initial capacity of 30,000 kw. Galvanised steel towers, with a standard spacing of 550 ft. on the straight and 100 ft. on curves, are to be employed. At Humber River a 1,250 span is required, with a normal height of 65 ft. for the line, and over the Welland Canal this height is increased to 150 ft., to allow of the passage underneath of ships. Stranded aluminium 3/0 B. & S. gauge conductors are to be used on all branches, and a somewhat larger section conductor to connect the branching point and power station at the Falls; these conductors will be carried by disk suspension type insulators, and a grounding cable will be provided for lightning protection. Messrs. Muralt and Co., New York, have been retained to supervise the construction of the work.

Carnoustie.—This well-known Scottish summer resort may soon be lighted by electricity. At present the illumination of the burgh is in the hands of a private company, with whom the T.C. is negotiating for the purchase of the concern. In the event of a failure in the negotiations, there is no obstacle in the way of the local authority coming to an arrangement with Dundee for the supply of electricity.

Clitheroe.—At the T.C. meeting on March 18th a letter was read from the B. of T., stating that it could not allow the question of establishing works in Clitheroe under the Electric Lighting Order to remain in abeyance for a further period of two years—the time requested by the Council. The Board granted an extension of one year, and if nothing is done in the meantime the Order will be revoked without further notice.

Continental Notes.—Austria.—The Union Bank has proposed to the Vienna municipal authorities a scheme for utilising the water-power of the Enns River. It expects to obtain

80,000 H.P., and is ready to invest about 2½ million sterling in the scheme. Large storage reservoirs will have to be constructed to store the water for summer use.

In the Tyrol, separate electricity works are planned at Laudeck, Sexten, Tranim, Rovereto, Kolsars, Kall, and Grossensatz. The water-power station, for the electrification of the Government Railways in Salzburg, is to be placed near Kuettan, and the water will be conveyed from the Fritzbash to the station by a conduit 7 kilometres long.

In Muhrn two hydro-electric stations will be begun shortly, one by the A.E.G. Union Electricitäts Gesellschaft, of Vienna, at Malhr-Schvenberg, and one at Dubitz Ko. Others have been decided upon by the municipal authorities of Tarnon, in Gilsia and Bekes, and Nagykoeroes, in Hungary. The latter is in the hands of the Hungarian Siemens-Schukertwerke, and will cost 603,000 kronen.

The town of Bistriz (Hungary) has abandoned its original project to erect a central station in favour of one on the canal emanating from the Bistriz river. Diesel engines will be required to supplement the smaller amount of water obtainable by this scheme.

The town of Kralowitz, in Bohemia, has arranged to expend 400,000 kroner in a generating station, which is to supply the whole district with light and power.

GERMANY.—The small town of Schwetzingen, near Mannheim, is to have an electricity works on which the Rhenische Schuckert Gesellschaft will expend £50,000.

An arrangement has been made by which the Kausiatische Siemens-Schuckert Works will erect at their own cost a central station and will maintain it and supply the Luebeck ironworks and the whole Luebeck district as well. A very large expenditure is anticipated.

Messrs. Landwehr & Schultz have the contract for a station at Rumbeck, near Scherpere, which will supply both these places, as well as the railway station, with light and power. The Munden-Ravensberger Elektricitäts-Werke, a new concern, will erect and equip a station at Kircheingen to supply the Huford (Minden) district. Another station is proposed by the Lienen municipal authorities.

The Steinbrucker Mining Association are about to electrically equip their smelting and iron works, and will erect a central station to supply from Obersdeid their other works and the following townships:—Achenbach, Breidenbach, Breidensheim, Kleingladenbuch, Wiederdieten, Oberdieten, Roth, Simmersbach, and Wiedenbach.

The Finance Committee of the Reichstag has rejected the proposed tax upon gas and electricity, along with numerous other taxes suggested by the Government.

SWEDEN.—A sum of 1,500,000 kr. has been voted by the Swedish Riksdag for the provision of distribution lines from the States power station at Trollhättan.

Cornwall.—A new electrical pumping set is being installed to unwater the Wheal Reath and Lady Gwendoline Mines (Breage district) for the South-West Cornwall Mines, Ltd.

Coventry.—The T.C. has agreed with respect to the sanction for £4,250 charged to the electric light undertaking, in connection with the refuse destructor, that the Electric Light Committee shall pay the interest and sinking fund charges yearly as they become due, and that the General Works Committee shall repay the amount; the charge for steam supplied from the refuse destructor is to be the subject of a separate account and dealt with accordingly.

Cullompton.—At a public meeting of residents held on March 16th, a resolution was passed welcoming the prospect of the establishment of the electric light and power scheme, the cost of which is estimated at £3,000. For lighting it is proposed to charge 6d. per unit, and for power 2½d.

Dublin.—A special meeting of the Council was held on the 16th inst., to consider the reports of the city treasurer and accountant upon the financial position of the electricity undertaking, and a subsequent report by the Lighting Committee was adopted, with an amendment deleting the proposed increase in price of electricity.

Faversham.—Solely with a view to economy, the T.C. has decided to reduce the staff at the electricity works, and to dispense with the services of the assistant engineer and clerk.

Fleetwood.—The U.D.C. has completed arrangements for a supply of power to the new factory of the Ice Co.

Frome.—It was stated at a L.G.B. inquiry on March 17th that there was a probability of the U.D.C. transferring the electric light undertaking to the contractors, Messrs. Edmundson, outright, in which case the Council would not require the unexercised sanction to loans amounting to £10,005, as the contractors would have to provide their own capital.

Grimsby.—The assessment of the electric light undertaking having been increased from £663 to £3,037, the T.C. has decided to consult an expert with a view to an appeal.

Hanwell.—The E.L. order of the U.D.C. has been transferred to the Metropolitan Electric Supply Co., which has repaid to the Council the sum of £550 expended in the matter.

Hastings.—The local gas company and the Corporation are at daggers drawn. On Tuesday an inquiry was held by an Inspector of the L.G.B. into an application by the Corporation to borrow £5,000 for the extension of the electric light mains and house services. The gas company was represented by counsel (Mr. Patrick Hastings) who opposed on behalf of his clients, as large ratepayers. Witnesses in support of the application were closely cross-examined, and counsel hinted that, in consequence of a previous application for a loan (for transforming 700 gas lamps into electric lamps) being refused, the Corporation had decided to carry out the work and pay the cost out of current rates during the next three years. Questions upon this motion were, however, overruled. After the previous success of the gas company, the decision of the Inspector will be awaited with considerable interest. Another instance of the feeling existing between the gas company and the Electricity Department was given a few days ago, when the solicitor to the gas company appeared before the magistrates and lodged an appeal, to be heard at the next Quarter Sessions, against the rate made by the Corporation on March 5th. Sureties in £300 to duly prosecute the appeal were entered into.

Iceland.—The Reykjavik T.C. has decided to accept the offer of Karl Franke, of Bremen, to provide an efficient lighting scheme, gas or electric, for the town, to be completed by next autumn.

India.—The latest report on the working of the Cauvery power scheme shows a net revenue of Rs. 17.58.346, including Rs. 14.47 263 received from the Kolar Goldfields. Up to date the capital sunk in the scheme has been Rs. 78.49.779. The net revenue, after deducting working expenses and interest, has been Rs. 56.07.926, which represent 71 per cent. on the capital expenditure. Improvements are being made by providing a more direct transmission route with spans of 400 to 1,620 ft. As showing the vagaries of Indian transmission work, the following, from the *Times of India*, is of interest:—"Owing to lightning trouble one transformer at Sivasamudram and two at the Kolar Goldfield were burnt, and also another on account of a breakdown of insulation. There were altogether 40 shutdowns for short periods during the year, viz., 24 shutdowns on the Bangalore transmission line and 16 on the Kolar transmission line. Of these 6 were due to lightning troubles on the line, and in 5 cases it was necessary to allow rebates to the mines. Twenty-three high-tension insulators (17 on the Kolar line and 6 on the Bangalore line) had to be changed, of which 5 were known to be damaged by lightning and 5 to be maliciously broken. Two defective poles of Indian timber and one jarrah wood pole were destroyed by lightning during the heavy storm in Bangalore city on the evening of May 6th. The distribution lines were damaged in different places, due to falling trees and branches."

Liverpool.—Mr. A. Bromley Holmes (consulting electrical engineer) in a report accompanying the manager's annual report on the Corporation tramways, published recently, points out that the rapid introduction of the metallic-filament electric lamp, however beneficial it may be in the future to the electric supply department, must for the present to a certain degree reduce the sale of electrical energy to the ordinary consumer for lighting purposes. The supply of energy to the tramways also seems likely to fall somewhat below the supply required last year, and under these circumstances he was unable to recommend any alteration in the rates at present charged for these services. The consumers of energy for power purposes for the most part make use of the supply for a very limited number of hours annually, and the scale of charges in force under these conditions does not admit of any reduction. On the other hand, the present scale does not offer sufficient inducement for long-hour users of power, and he submits the following recommendation, which, he believes, will meet the case:—"That the option of a special alternative rate, based on the payment of a fixed sum per kilowatt on the rated capacity of all plant installed, together with a reduced rate per unit actually consumed, be granted to any consumer of electrical energy for power purposes" under certain specified conditions. The rate suggested is (*a*) £4 per KW. per annum, payable in four equal quarterly instalments; (*b*) ½d. per unit, with the option of an alternative method of charging on the maximum rate of supply actually observed, instead of on the rated capacity of the plant installed of £8 per KW. per annum.

London.—MARYLEBONE.—At its next meeting the B.C. is to consider the refusal of the L.C.C. to grant a loan of £8,000 for converting 1,964 street lamps to electric lighting. The Electric Lighting Committee contends that the L.C.C. has offered no valid reason for refusing the loan, and proposes a public inquiry by the L.G.B. In the meantime the Committee has decided to carry out the proposed alteration, and is arranging for the experimental conversion of one street before proceeding with the whole.

STEPNEY.—The B.C. is to apply to the L.C.C. for sanction to borrow £10,000 for laying feeder mains from Blyth's Wharf to the eastern portion of the borough. Tenders are to be invited for steam, feed, circulating water and other pipe work, valves, centrifugal pumps, hot well, &c., in connection with the Blyth's Wharf extension scheme.

Partick.—A deputation from the T.C. has visited Belfast with a view to inspecting the Corporation electric supply undertaking.

Peterborough.—The assessment of the electricity undertaking, which was increased to £1,200, has been fixed at £1,050 by mutual agreement.

Plymouth.—The Electricity Committee has had under consideration a proposal by the local gas company for a demonstration as to the relative value of gas and electric street lighting, and has invited the company to submit suggestions for improving the gas lighting.

Portadown.—The T.C., after considering reports from various sources as to electric lighting and the purchase of the gas undertaking, has decided to abandon negotiations as regards the latter project, and expresses its approval of the electric lighting scheme if the necessary support is forthcoming locally.

Preston.—The T.C., having again had under consideration the purchase of the undertaking of the National Electric Supply Co., Ltd., has decided to call in an expert to advise as to the value of the plant.

Saffron Walden.—The T.C. has asked the B. of T. to renew the E.L. Order for another year.

Sheffield.—The new rolling mills recently started up at Tinsley by Messrs. Thos. Firth & Sons contain a very complete electrical equipment. The power plant includes three water-tube boilers supplying steam to two 1,000-kw. 1,000-volt three-phase turbo-generators, which are provided with condensing plant, cooling towers, &c. The rolling mill plant includes 18-in., 12-in., 10-in., and 8-in. rod and bar mills, also 20-in., 18-in., and 16-in. sheet mills; each mill is motor-driven, two being direct-coupled, and the remainder rope-driven. The small motors and lighting are run off 200-volt circuits, suitable transforming plant being installed for this purpose.

South Shields.—The bursting of a water main on the 18th inst. was attended by rather curious results. The pipe gave way in the vicinity of the Corporation electrical station, and the premises were compietely flooded. The quantity of water which accumulated before the supply could be cut off was so great that a fire engine had to be used to pump it out; meanwhile the tramways were brought to a standstill for about an hour, while the lighting supply was off for a considerably longer period. While efforts were being made to cope with the difficulty, Mr. J. H. Cawthra, the electrical engineer, fell from a gangway and was injured.

Sunderland.—At a special meeting of the T.C. recently, the question of opposing the "further powers" Bill of the County of Durham Electric Power Supply Co., was discussed at length, and eventually it was agreed to oppose the Bill.

Torquay.—The Electric Lighting Committee, at a special meeting held on the 19th inst., unanimously decided to adopt a flat rate of 4½d. per unit as from Ladyday, 1909, for energy supplied for private lighting purposes, in place of the system at present in operation.

TRAMWAY and RAILWAY NOTES.

Belfast.—At the weekly meeting of the Tramway and Electrical Committee, a deputation appeared urging the Corporation to arrange with the Cavehill and Whitewell Co. for through travelling from the suburbs without further delay. Subsequently it was recommended to the Corporation that a working arrangement with the company be entered into on the terms of the draft agreement as now settled, subject to the revision of the B. of T. It was reported that Castle Junction—the heart of the tramway system—would be lighted by flame arc lamps as an experiment.

Handsworth.—An effort is to be made to overcome the difficulty which arose some months ago between the local authorities, with reference to the Handsworth tramways. Because the Handsworth and Aston Committees and the City of Birmingham Tramways Co. could not agree to terms respecting the working of the lines in their respective districts, passengers using the Newtown Row route have had to submit to the inconvenience of taking three tickets for a distance of a little over two miles. Now, however, it is said, the Handsworth Committee is prepared to re-open negotiations, and Aston being willing, it is hoped that a conference with the company will result in a friendly settlement of the difficulty.

Lancashire Tramways Scheme.—The Preston Corporation has now withdrawn its opposition to the Preston, Chorley and Horwich Tramways Bill. The L. and Y. Railway Co. and the Wigan Corporation have also withdrawn their opposition. The proposed tramway will connect the important towns of Preston and Bolton, passing through Adlington and Chorley and linking up with the Bolton system at Horwich.

Liverpool.—The negotiations between the Tramways Committee and the Liverpool Overhead Railway Co., with a view to the adoption of through fares, have come to nothing, owing to the inability of either party to reduce its fares.

Rawtenstall.—The T.C. has intimated that it is its intention to have the new electric tramways running in the borough by May 1st. The generating station is now practically completed, as also is the track. The track work in the Bacup borough is expected to be ready for the cars to run over it by Whit week.

Rhyl.—The U.D.C. having refused to carry out the suggestion of the Light Railway Commissioners with reference to the proposed tramway from Rhyl to Prestatyn, a vote was taken on Saturday by the Ratepayers' Association, and resulted in an overwhelming majority in favour of the tramways.

Southend-on-Sea.—The powers under the Southend and District Light Railways (Extension) Order, 1904, having expired, the T.C. has decided to apply to the Light Railway Commissioners for an order to revive them.

Continental.—Germany.—The example set by the towns of Schöneberg and Wilmersdorf in deciding to construct underground electric railways for the purpose of facilitating communication with Berlin, is now to be followed by the town of Charlottenburg in respect of the line from the Nollendorfplats to the circle railway in the new Kent Strasse. During the consideration of the question it was found that the projected railway would not only meet the local traffic requirements, but also that an extension of the line to the central parts of Berlin, on the one hand, and to the southern parts of Berlin and to Rixdorf, on the other, might be assured, and that the possibility existed of a connection being formed with the proposed Wilmersdorf and Schöneberg railways at joint stations. It is estimated that the expenditure on the construction of the Charlottenburg railway would amount to £1,000,000, which would be raised by the flotation of a loan. The question who would undertake the working of the line has not yet been determined, but in case an agreement is not arrived at with the Elevated and Underground Electric Railway Co., it is probable that a working union will be established with the town of Schöneberg, although the railway could be operated quite independently.

Herr von Breitenbach, the Minister of Public Works, proposes to introduce a Bill for the electrification of the main line between Magdeburg and Leipsig.

Switzerland.—It is stated that the financing of the electric narrow-gauge railway between Zweisimmen and Lenk has now been arranged for, and the scheme will come before the next session of the Council of Bern for approval. The cost is put at 1,500,000 fr.

Liverpool.—The annual report of Mr. C. W. Mallins, general manager of the Corporation tramways, issued recently, shows that 121,927,883 passengers were carried during 1908, with £563,144 receipts, and mileage 12,244,353. The comparison with 1907 is:—Passengers, a decrease of 2,115,356, equal to 1·7 per cent.; receipts, a decrease of £9,678, equal to 1·7 per cent. The average earnings per car-mile amounted to 11·04d., as against 11·24d. for 1907. The length of track operated is the same as in the previous year, viz., 104 miles; 534 cars were in use, and the total number of cars running in and out of the city per day was 7,599, including 5,792 cars arriving at and leaving the Pierhead.

Glasgow.—The Tramways Committee has received a deputation from the ratepayers of the Provenmill district, asking that the tramway system be extended there. The proposal will be carefully considered.

Dundee.—The T.C. has agreed not to extend the tramways up Arklay Street, and along Clepington Road, to join the Strathmartine Road system. The manager, who reported that the extension would cost £12,000, said the tramways were not capable of carrying any additional heavy burden at present, and at the same time maintaining the existing low average fares.

TELEGRAPH and TELEPHONE NOTES.

India.—In reply to a question regarding negotiations involving the possible leasing by the Indian Government of a trans-Indian telegraph line to any of the telegraph companies which were partners with India in the Joint-Purse pool, the Under-Secretary for India recently stated that it was known that the Eastern and the Eastern Extension Telegraph Companies had applied to the Government of India for permission to telegraph their trans-Indian traffic directly between their cable stations at Bombay and Madras, instead of handing it over to the Indian Telegraph Department for transmission, and it was believed that this application was at present under the consideration of the Government of India.

Italy.—The telegraph system at the end of 1906 totalled 47,885 k.n. of line and 204,797 km. of wire. The system of submarine cables consisted of 4,011,886 metres belonging to the State and private companies. The total number of telegraph offices open in 1906 was 7,444. Altogether 7,701 instruments were employed, besides 4,355 accumulators. The traffic comprised 9,141,503 forwarded private inland messages handled by the Government offices; 626,174 private messages handled by the railway telegraph offices; and 1,361,509 messages sent to foreign places. There were also 3,226,318 official and service messages, making a total of 14,355,504 forwarded messages. Received messages totalled 19,634,501, of which 18,239,251 were inland and 1,395,250 were received from foreign countries, and together with 35,180,884 telegrams passing in transit, the traffic altogether amounted to

69,170,889 telegrams. The telephone service increased considerably, and the receipts on account of this service were 1,487,614 fr.; the total receipts for both telegraph and telephone services were 2,192,326 fr. During the year under review 1,226 radio-telegrams were transmitted and 1,962 received by the various wireless stations. —*Journal Télégraphique.*

Jamaica.—A deputation of the Jamaica Telephone Co. recently waited on the Governor and discussed with him matters connected with the proposal of the Government to take over the telephone system. The licence to the company was granted for ten years and was then renewed for two only, and the deputation pressed for a further extension. The matter has been referred to a select committee of the Council.

Newfoundland.—An arrangement has been made between the Government of Newfoundland and the Commercial Cable Co., according to which the company will cut one of its five Atlantic cables at the Flemish Cap, 300 miles east of Newfoundland, and connect to the European end a new cable running to St. John's, Newfoundland, and from there direct to New York. The company will then have the only direct cable from New York City to Ireland, giving an increased speed of communication of 35 per cent., and the only Atlantic cable from Europe to Newfoundland. The operation requires the purchase and laying of 1,700 miles of new cable; 900 miles will be thrown out of use, and will be picked up as far as possible.

Panama.—The National Assembly has authorised the Executive Power to expend up to £20,000 in the construction of telegraph lines in the Republic of Panama, to provide telephone services between several towns, and to erect wireless stations between Colon and Bocas del Toro.—*Board of Trade Journal.*

Paris Telegraph Strike.—The strike continued during the whole of last week, practically the whole of the postal and telegraphic communications with other towns being completely disorganised, and for a time Paris was practically isolated so far as these services were concerned. Millions of letters, and hundreds of thousands of telegrams, were delayed. Much of the through traffic from Britain to countries beyond France was diverted *viâ* Germany, or was handled by the cable companies. Military telegraphists were employed to some extent to serve the Central Telegraph Office, but the service was very inadequate. Several other French towns were involved in the strike. At the beginning of this week material improvement took place, as the result of negotiations between the Government and the strikers. The latter demanded the resignation of M. Simyan, and the reinstatement of all employés; the Government refused to grant these terms, but allowed it to be understood that concessions would be made if the strikers resumed work, and on Tuesday last the strike was practically at an end. The victory appears to rest with the strikers.

Portugal.—The telegraph system at the end of the year 1905-6 had a total of 9,392·3 km. of line and 21,226·4 km. of wire. The total number of offices open was 506. The traffic consisted of 1,480,285 telegrams sent, 1,700,066 received, and 3,178,569 in transit, making a total of 6,358,920 telegrams—an increase of 5·96 per cent. over the previous year. The receipts for forwarded telegrams were 1,370,373 fr., for received telegrams 150,948 fr., and for transit telegrams 1,371,141 fr.; proportions collected on behalf of other administrations and companies were 1,356,848 fr., making a total collection of 4,249,310 fr. The telephone system is not very important, and the yield in revenue from this source was only 61,259 fr.; the system totalled 356 km. of line and 993 km. of wire.—*Journal Télégraphique.*

Post Office Accounts.—The total income of the Post Office in respect of telegraphs and telephones for the past financial year amounted to £4,484,100, as against £4,369,200 in the preceding period, and the expenditure to £5,336,500, as against £5,011,900, making the excess of outlay over income £852,400, as compared with £642,700. The expenditure, however, includes several items in the nature of capital outlay, and the revenue expenditure amounts only to £4,614,300, bringing the adverse balance down to £130,200. The Departmental Committee on Telegraph and Telephone Accounts has issued its report.

Telegraph Interruptions and Repairs:—

	Interrupted.	Repaired.
Port Arthur-Chifu	March 9, 1904	
Pontianak-Saigon	Sept. 16, 1908	
Tourane-Amoy	Jan. 19, 1909	
Cayenne-Salinas	Feb. 27, 1909	
Tenedos-Lemnos	Mar. 19, 1909	Mar. 20, 1909

Wireless Telegraphy.—The Eiffel Tower will shortly be enabled to receive from the Observatory the exact time, which it will transmit to all ships in communication with it.

The Admiralty wireless station at the entrance to the Humber has now been completed.

A Bill has been introduced into the Dominion House of Commons respecting the installation of wireless telegraphy on ships. Vessels carrying passengers and over 500 tons are to be equipped, and an officer capable of operating the system must be aboard. Freight vessels of over 1,500 tons must also be so equipped.

The wireless telegraph stations at Mukdisbu, Merea, Brava and Guimbo (British East Africa), are ready to begin a commercial service between the interior of the Benadir colony and ships.

CONTRACTS OPEN and CLOSED.

OPEN.

Algiers.—April 1st. The Prefect of Oran will receive applications for a concession to construct and work electric tramways about 18 miles in length.

Australia.—Melbourne.—April 23rd. A power plant for the Central Telephone Exchange, Melbourne. See "Official Notices" March 5th.

Sydney.—May 31st. Two 4,700-k.v.a. turbo-alternators, with condensing plant, &c., and one 447-k.v.a. ditto, for the Council's electricity supply department. See "Official Notices" March 12th.

Ayr.—Electric light fittings and general goods for one year for the District Lunacy Board. J. E. Shaw, Clerk, Ayr.

Belgium.—Brussels.—April 10th. Tenders are required for 10 lots of apparatus, appliances and material for electric lighting of railway trains, by the Administration de Chemins de fer de l'Etat Belge.

Blackpool.—Cables for the Electricity Committee. See "Official Notices" to-day.

Cardiff.—March 26th. Switchboard, pipework, and cables for the Corporation. See "Official Notices" March 12th.

Edinburgh.—March 29th. Materials for the Electricity Supply Department. See "Official Notices" March 12th.

Fareham.—April 22nd. Electric supply mains, transformers and arc lamps and accessories for the Council. See "Official Notices" to-day.

France.—Paris.—April 6th. Tenders are required for 100 Morse apparatus, and for 2 tons of 0·6 mm. bronze wire, by the Central Depôt of the Army Telegraph Service, 51 Bis, Boulevard de Latour-Manbourg.

Havre.—April 20th. A large amount of electrical equipment will be required for harbour extensions by the Administration du Port de Havre.

Germany.—Bremen.—April 5th. An electric crane is required by the Lower Weser Improvement Board.

Stettin.—April 26th. The Prussian State Railways Administration requires tenders for 10,000 incandescent electric lamps and accessories.

Glasgow.—April 5th. Materials for the Corporation tramways department for one year. Specifications from Mr. J. Dalrymple, Manager.

Goole.—Electrical illuminations of grounds for gala, August 19th. T. D. Clegg, Arcade Sale Rooms, Goole.

Govan.—March 30th. Stores for the electricity department. See "Official Notices" March 12th.

Holland.—Utrecht.—April 15th. The Holland Railways Co. requires tenders for copper wire, chemicals, and other telegraph material for the year 1909-10.

Italy.—Rome.—April 5th. The Minister for Posts and Telegraphs requires tenders for iron telegraph brackets as follows: 40,500 curved (4½d.), 1,000 straight (3·7d.), 2,200 for walls (4½d.). Total about £800. The date for sending in tenders for electric lamps for the Italian Royal Arsenals has been postponed.

London.—Hackney.—April 22nd and May 6th. Arc lamp carbons for one year; also cables, troughing, &c. See two "Official Notices" March 12th.

Metropolitan Asylums Board.—March 26th. Electric light installation for the N.E. Fever Hospital, for the above Board. See "Official Notices" March 12th.

Putney.—Alterations to the electric light installation at the Putney Library. The Wandsworth B.C. Libraries Committee is to invite fresh tenders, the contractors whose tender was accepted having objected to one of the conditions.

Stepney.—The Council was at Wednesday's meeting to approve a draft advertisement inviting tenders for steam, feed, and other pipe work, valves, centrifugal pumps, hot well, &c., for the Blyth's Wharf Extension Scheme.

Manchester.—April 5th. Signal, telegraph and electric light wires for the L. and Y. Railway Co. for a year. Mr. Waring, Stores Department, Osborne Street, Manchester.

Norway.—Drammen.—April 6th. Tenders are invited by the T.C. for one 1·5 ton and one 2·5 to 5-ton electric cranes for the harbour. Tenders to the Town Engineer. Local representation of tendering firm is essential.

Partick.—April 3rd. Materials for the T.C. electricity department. See "Official Notices" March 12th.

Russia.—Ovel.—May 14th. The T.C. is inviting offers for a concession to install and work a public electric light system, which will eventually be taken over by the municipality. The existing electric tramway company at present derive a revenue of 50,000 roubles yearly from the supply of lighting current to private consumers, and this asset will pass over to the concessionnaire.

Salford.—March 29th. Re-wiring at the Royal Technical Institute, for the Electricity Committee. See "Official Notices" March 12th.

Swindon.—April 10th. Materials for the Electricity and Tramway Department. See "Official Notices" March 19th.

Whitley Bridge.—April 3rd. Electric light installation at waterworks for Wakefield T.C. W. Haddock, Town Clerk.

Woodbridge.—June 1st. The U.D.C. wants to hear from a company that would establish electric light works in its district, and light the streets electrically. See "Official Notices" to-day.

York.—March 31st. Construction of 5½ miles of light railways in the city, and half-a-mile of railways within the rural district of Escrick, for the Corporation. See "Official Notices" March 5th.

CLOSED.

Barking.—The T.C. received the following tenders for mechanical stokers for four of the boilers at the electricity works, the prices being exclusive of the cost of unskilled labour and brickwork:—

Babcock & Wilcox, Ltd.	£680
Bennis & Co., Ltd. (accepted)	687
Erith Engineering Co., Ltd.	695
Underfeed Stoker Co., Ltd.	712

Belgium.—The Union Electrique Co., of Brussels, has secured a contract for the installation of an electrical plant at the new colliery at present in course of completion at Hautrage. The plant will comprise two 300-kw. turbo-generators, which will supply current to two 350-h.p. turbo-pumps and one of 250 h.p.

Bexhill.—The Electric Lighting Committee of the T.C. has recommended the acceptance of the following tenders:—

Bellis & Morcom, Ltd.—Surface condenser, with pumps and compound two-crank engine, £730.
Hebb & Co.—Cooling tower, £388.
Babcock & Wilcox.—Chain grate stoker, £160.

Croydon.—The T.C. has accepted the tender of William Cory & Son, Ltd., for the annual supply of Welsh steam coal to the electricity undertaking.

The Guardians have accepted the tender of Pryke & Palmer for electrical fittings.

East Ham.—The T.C. has accepted the tender of Newton & Co., at £362, for motors and switchboard required in connection with the raising of the effluent at the sewage works.

Glasgow.—The Tramways Committee has accepted the following tenders:—

Armature coils.—British Westinghouse Co., Ltd.
Special trackwork and spare points.—Lorain Steel Co.
High-speed steel.—Wm. Jessop & Son, Ltd.
Copper bonds.—B. I. and Helsby Cables, Ltd.
Steel rails and fishplates.—Lorain Steel Co.

London.—L.C.C.—The Main Drainage Committee has reported to the Council on the tenders received for seven vertical gas engines, two air compressors, four air receivers, &c., required in connection with the enlargement of the Abbey Mills pumping station:—

Premier Gas Engine Co., Ltd.	£22,420
Campbell Gas Engine Co., Ltd.	25,510
Newton Bros.	26,000
British Westinghouse Co., Ltd.	27,000
Crossley Bros., Ltd.	28,505
Anderston Foundry Co., Ltd.	—

The Anderston Foundry Co., Ltd., do not quote a total amount in their tender, but the prices in the schedule, exclusive of the cost of piping, amount to £33,721. The specification was intentionally made an open one, and details were to a great extent left to the firms tendering. After careful consideration of the designs submitted, certain modifications were found to be necessary, and, as a result, the following firms are prepared to amend their designs to meet the Council's requirements, subject to the amounts of their tenders being increased:—

Premier Gas Engine Co., Ltd. (accepted)	£23,558
Campbell Gas Engine Co., Ltd.	26,560
British Westinghouse Co., Ltd.	27,476

The Committee recommend that the tender of the Premier Gas Engine Co., at the increased price, should be accepted.

The Highways Committee has accepted the tender of Hadfield's Steel Foundry Co., Ltd., to supply special trackwork, check rails, &c., for a Shoreditch junction line, at £591.

The Asylums Committee has placed contracts for electrical sundries for the coming year as follows:—Yorkshire Cable Co., Ltd., H. C. Timpson, Siemens Bros. & Co., Ltd., Saxonia Electrical Wire Co., Ltd., Vian & Edwards, Sunbeam Lamp Co., Ltd., Falk, Stadelmann & Co., General Electric Co., Ltd., Geo. McClellan and Co., Cox-Walkers, Ltd. Tenders for electric lamps from Mackey's Electric Lamp Co., Ltd., and the British Thomson-Houston Co., Ltd., have also been accepted; and for india-rubber goods from the India-rubber, Gutta-percha and Telegraph Works Co., the N. B. Rubber Co., Ltd., and the Dunlop Rubber Co., Ltd.

Battersea.—The following tenders for materials for one year are recommended by the Lighting Committee for acceptance:—

Oils.—Price's Candle Co., Ltd.
Engine-room stores.—W. H. Willcox & Co., Ltd.
Asbestos, &c., packing.—K. Beldam & Co.
Arc lamp carbons.—Sloan Electrical Co., Ltd.
Nernst lamps and fittings.—Electrical Co., Ltd.
Incandescent lamps.—British Thomson-Houston Co., Ltd.
Tools, &c.—Pryke & Palmer.
Bitumen.—Callender's Cable Co.

Camberwell.—The B.C. has accepted the following tenders for annual supplies, &c., the figures in parenthesis showing the prices now paid:—

S. Burnby & Son.—Maxim electric lamps, English make, plain, 100 and 200 volts, 8 and 16 c.p., 6s. per doz. (7s.); 32 c.p., 8s. per doz. (8s.); English make, frosted, 8 and 16 c.p., 6s. 6d. per doz. (7s. 6d.); 32 c.p., 8s. 6d. per doz. (8s. 6d.). Tantalum electric lamps, 100 volts, 8 and 16 c.p., 20s. per doz. Osram electric lamps, 100 volts, no c.p. mentioned, 33s. 6d. per doz.; 30 c.p., 36s. per doz.; 50 c.p., 38s. 3d. per doz.

Islington.—The tenders of Pryke & Palmer and Baxter and Caunter for electrical fittings and sundries have been accepted by the Guardians.

Stepney.—The Council recently accepted the offer of the Tudor Accumulator Co., Ltd., for taking back the existing battery at Osborn Street Station and substituting one of 250 cells. It is now entering into an agreement with the firm for the maintenance of the new battery for 10 years at £34 per annum.

The Council is recommended to accept the tender of Mr. D. T. Jackson, at £6,900, for condenser pipework, settling tanks, valve chamber, and river wall at Blyth's Wharf.

Plymouth.—Mr. Braulik writes to say that the price quoted by him for Conradty C quality carbons for the Corporation (see Electrical Review, March 12th, p. 429) was a clerical error, which has since been rectified.

Southend-on-Sea.—The T.C. has accepted the tender of the British Insulated & Helsby Cables, Ltd., for section pillars and 18 switch fuses, at £127 5s. and £54 respectively; and that of Callender's Cable & Construction Co. for 16 expansion joints for feeder cables, at £38.

Swansea.—The T.C. received the following tenders in connection with the electrical engineering equipment of the new technical college:—

8-kw. Experimental Motor-Alternator with Special Switchboard.

Sunderland Forge & Engineering Co. (accepted)	£277
Crompton & Co.	330

Direct-Current Plant, with Switchboards and Accumulators.

General Electric Co. (accepted at £200)	£229
Electrical Co.	257

Alternating-Current Plant, Complete with Switchboard.

General Electric Co. (accepted at £200)	£212
Electrical Co.	211

Turkey.—Messrs. Warren, Beattie & Co., Ltd., of Middlesbrough-on-Tees, have secured from the municipality of Ouschak the contract for the lighting of the town. Ouschak is a town in the interior of Asia Minor, and one of the principal towns in the carpet industry.

West Ham.—The B.C. has accepted the following tenders for annual supplies of electrical fittings and accessories:—

Evered & Co., Ltd.; Sunbeam Lamp Co.; Metallic Seamless Tube Co.; British Electric and Manufacturing Co.; E.M.F. Manufacturing Co.; Siemens Bros. Dynamo Works; G. Braulik; Electric and Ordnance Accessories Co.; General Electric Co.; J. H. Tucker & Co.; W. T. Henley's Co.; British Westinghouse Co.; Armorduct Manufacturing Co.; Simplex Conduits; Equipment and Engineering Co.; Davis Electrical Co.; Baxter & Caunter.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERAVON.—Rebuilding the Railway Tavern, Water Street; J. C. Rees, architect, The Parade, Neath.

ABERDEENSHIRE.—Proposed public hall for Craigievar.

ACCRINGTON.—Whalley Road, Congregational Sunday school extensions &c. (£500); new Congregational Church also contemplated.

ADLINGTON (Lancs.).—Church day schools (£3,050); L. Fairclough, builder, Chorley and Adlington.

ALDERLEY EDGE.—Probable reopening of copper mines on Lord Stanley's estates.

ANNFIELD PLAIN (Co. Durham).—Shops, warehouses and stabling, for W. Wilson, Ltd.; D. M. Spence, architect, Shotley Bridge.

ASTLEY (Lancs.).—Additional blocks of houses; Pilkington Coal Co.'

ATHERTON.—Twenty-four houses, Coalpit Lane; J. T. Smith. Ten houses, Elizabeth Street; Langley & Annett.

AYR (N.B.).—Additions, Lorne Castle (£5,000); H. E. Clifford, architect, 228, St. Vincent Street, Glasgow.

BACUP.—Two hundred houses on Esther Estate, for B. Brearley, The Poplars, Bacup.

BAKEWELL.—New Parish Institute; Rev. Canon Abraham.

BARNSLEY.—Houses, Fife Street, for J. Dunk; Blenheim Road, for Herbert Drake; Tower Street, for S. Dryden; Middlesex Street, for J. Ward; Vernon Street North, for G. H. Gray; Shaw Lane, for J. Raynor; shop, Cresswell Street, Pogmoor, for J. Mellor.

BERWICK-ON-TWEED.—Tenements in Middle Street, Spittal; D. Bailey, Percy Cottage, Rothbury.

BEXHILL.—Dwelling house and stabling, Glover's Lane, Sidley, for A. Goldsmith; J. B. Wall, architect, 13, Devonshire Road. New billiard room, "Borezell," Sea Road, for Mrs. Dunn. Laundry, Bragg's Lane, for F. G. Miller; C. W. Spencer, architect. Bungalow, Norman's Bay, for H. Gladwell; R. Wilson, architect. Fourteen houses in Springfield Road, for J. Woolnough. Colonnade, shelters and bandstand, for the T.C.; G. Ball, surveyor.

BIDEFORD.—New United Methodist Church.

BIRDWELL (near Barnsley).—Working Men's Club and Institute; R. and W. Dixon, architects, 5, Eastgate, Barnsley.

BIRKDALE (Southport).—New aisles and vestries for St. John's Church; Austin & Paley, architects, Lancaster.

BIRKENHEAD.—Additions to isolation hospital; C. Brownridge, surveyor, Birkenhead Town Council.

BLACKBURN.—Proposed police buildings, public halls, &c., for the T.C. (£113,000); Briggs, Wolstenholme and Thornley, and Stones and Stones, joint architects, Richmond Terrace, Blackburn.

BLIDWORTH (near Mansfield).—Colliery developments by the Bolsover Colliery Co.

BOLTON.—Rebuilding portions of Belmont Bleachworks, for Deakin, Ltd. Extensions at works in Nelson Street; Entwistle & Gass, iron-founders. New property in Chorley New Road; G. H. Pearse, contractor, Embden Street, Bolton.

BRECON.—County school for girls; C. W. Best, architect, 8, Lion Street, Brecon.

BRIDGWATER.—Proposed alterations and additions to the municipal buildings, for the T.C. (£8,500). New Wesleyan Sunday school; the Rev. J. Bransom.

BRIDLINGTON.—Three houses (£880); C. F. Johnson, architect, Westgate, Bridlington; R. Musk & Son, builders, Bridlington.

BRIERLEY HILL (Staffs.).—Sewerage scheme for the U.D.C. (£20,000).

BRIGHOUSE.—Repairs, after fire, to Grove Mills, for Lister, Booth & Co., Ltd.

BROMLEY.—Adaptation of the old Wesleyan mission hall, Farwig Lane, for kinematograph entertainment purposes; G. Perfect.

BROUGHTY FERRY.—Improvements and alterations on property in Brook and Fort Streets, for R. Baxter, 5, Douglas Terrace.

BURNLEY.—Mission Church, Owen Street; Rev. T. H. Taylor, Habergham Vicarage. Warehouse in Raws Street; Wood & Co. Skating rink in Church Street; C. Riley, architect. Burnley. Additions to electric light station; G. H. Pickles, architect, Burnley.

BURSLEM.—Alterations and additions to the Ricardo Arms; S. Allsopp and Sons. Oven and sagger house, Furlong Lane; T. A. Simpson and Co., Tile Works, Burslem. Six houses, Port Street; G. A. Foster.

BUXTON.—Alterations and additions to business premises, Spring Gardens, for E. White; G. E. Garlick, architect, Quadrant Chambers, Buxton.

CARLISLE.—Extension of Messrs. Buck's Atlas Works (electricity will probably be used for driving and lighting).

CARSHALTON.—Houses, 19, in Stanley Road; A. B. Cook, builder, Wallington. Eight, Stanley Park Road, Messrs. Foulkner; and seven, Stanley Park Road, W. King.

CEFN-Y-COED.—School; G. A. Hutchins, architect, Montgomery.

CHADDERTON (near Oldham).—Two villas, Middleton Road, for Ashworth and Taylor; 10 houses and shop, Whitegate Lane, for W. & J. Hague; extension of offices, for the Gorton Spinning Co.

CHADWELL ST. MARY (Essex).—Convent, Malta Road, for the Mother Superior of the Convent of St. Mary.

CHESTER.—Proposed cavalry barracks under consideration; rebuilding business premises, Bridge Street Row, for A. Richardson, music warehouse; new Congregational Church in the Sealand district; probable reinstatement, after fire, of paint works, Egerton Street, for D. Morris & Co. (damage, £1,000).

CHESTERFIELD.—School (432 places) at Whittington Moor, for Derbyshire C.C.; G. H. Widdows, architect, St. Mary's Gate, Derby.

CHESTER-LE-STREET (Co. Durham).—Proposed new Congregational Church, Front Street; Rev. J. S. Williams, pastor.

CHEVINGTON.—Additions to All Saints' Church; Fawcett & Atkinson, architects, 4, Trumpington Street, Cambridge.

CHICHESTER.—Two pairs semi-detached villas at Summersdale; F. Hill, builder.

CLAYTON (near Manchester).—New Congregational Church (£4,500).

CLAYTON-LE-MOORS.—School (£12,000); R. Littler, Ribblesdale Place, Preston.

CLITHEROE.—Repairs at Messrs. Gurnett's weaving mills, Lowmoor, after fire.

CLOGHEEN (Co. Tipperary).—New schools; J. Bearne & Sons, contractors Waterford.

COVENTRY.—Public mortuary; J. Swindlehurst, St. Mary's Hall, Coventry.

COWES (I.W.).—Additions to "The Hawthorns," for Rev. A. R. White.

CREDITON.—Proposed County School for Girls, with house for head teacher and 20 boarders (£6,000).

CREWE.—New sorting office (£13,000); H.M. Office of Works, Westminster.

CREWKERNE.—Additions North Street School (£800); C. H. Bothamley, Weston-super-Mare.

CROYDON.—Stabling, offices and buildings, for Lancaster & Co, High Street, Bromley.

CRUMLIN (Mon.).—Miners' rescue brigade station, for the Monmouthshire Coal Owners' Association; A. F. Webb, architect, High Street, Blackwood, Mon.

CUDWORTH.—Proposed Council offices for the U.D.C. (£3,500); Mr. Moxon, surveyor.

DARLINGTON.—Reading room, &c., for the Darlington Club and Institute, Ltd.; G. W. Davis, architect, Tubwell Row, Darlington. New works, for Messrs. Tinsley. Four new churches projected; Rev. D. Walker, Vicar of Darlington. New school, Dodmire Estate, for the T.C.; Geo. Winter, Borough Surveyor.

DERBYSHIRE.—Extensive alterations and additions to Alsop Hall, for Lord Hindlip; J. Croad, builder, Portland Street, Portsmouth.

DEVONPORT.—Boys' home, for the Three Towns.

DEWSBURY.—Nurses' home for the B.G., to be lit by electricity; W. Hanstock and Son, architects, Branch Road, Batley.

DIPTON (Co. Durham).—Colliery developments by J. Bowers & Partners.

DONCASTER.—Municipal high school for girls (£18,000); J. M. Bottomley, Son and Wellburn, architects, Leeds.

DORCHESTER.—Additions to isolation hospital; P. T. Harrison, architect, Town Hall, Dorchester.

DORKING.—Refuse destructor house; J. Matthews, Dorking.

DOUGLAS (I.O.M.).—New schools in connection with St. Andrew's Presbyterian Church; G. & W. R. Kay, architects.

DUBLIN.—Completion Royal Victoria Hospital, Adelaide Road (£6,000); J. & W. Stewart, Ltd., contractors, Dublin.

DUNDEE.—Alteration to shop, for A. Duncan & Co., Murraygate; alteration to shop, for W. P. Gracie, Murraygate; alterations to shop in Union Street, for the trustees of the Rev. A. C Wright.

EAST BOLDON.—Premises for Co-operative Society; C. Bell, architect, 17, Norfolk Street, Sunderland.

EASTLEIGH (Hants).—Six houses in Chamberlayne Road, Eastleigh, for C. Lubbock, Festing Grove, Southsea; ten houses, in Chamberlayne Road, Eastleigh, for F. Colenutt, Up Natch, Basingstoke; seven houses in Southampton Road, Eastleigh, for E. Fullbrook, High Street, Eastleigh; alterations to 60, Market Street, for W. Dibben, builders' merchant, Southampton; alterations and additions to 43 and 45, Market Street, for G. Franklin, Portland Place, Southampton; additions to "Haslemere," Montague Road, Bishopstoke, for Dr. E. W. Simmons; 150 houses at Hampton Park.

EASTWOOD.—School (£11,000); E. Hooley, Shire Hall, Nottingham.

EDGELEY (Stockport).—Proposed new Primitive Methodist Church and Schools.

EDINBURGH.—Skating rink for the Edinburgh Marine Gardens, Ltd.; J. D. Gibson, surveyor, 60, Frederick Street, Edinburgh. Hall in Gifford Park, in connection with Mayfield U.F. Church (£2,000), Rev. L. Davidson, minister. New St. David's Established Church.

ELSWICK (near Newcastle-on-Tyne).—Extensions projected; Armstrong, Whitworth & Co., engineers.

EPSOM.—Fire station; E. R. Capon, surveyor, Epsom U.D.C.

EXETER.—Day Training College, for the T.C. (£7,764).

FALLOWFIELD (Manchester).—Proposed new municipal school (£13,000); Director of Education, Manchester.

FARINGTON.—Church; J. Seward, architect, 145, Church Street, Preston.

FELIXSTOWE.—Pavilion and spa on Hamilton Cliffs, for the U.D.C. (£4,000).

FELTHAM.—Wesleyan Church (£3,000); H. Somerford & Son, builders, 104, Manor Street, Clapton.

FERRYHILL (Co. Durham).—Eight houses; Wilkinson & Crowley, architects, 30, Mosley Street, Newcastle-on-Tyne.

FIFE.—Lodging house at Kinglassie for the Fifeshire Homes Syndicate; the Secretary. Alterations and additions to infant school at Cardenden; Clerk, Auchterderran School Board.

FLEETWOOD.—Eighteen houses, Darbishire Road, for the Russell Building and Contracting Co.; additions to factory, Wyre Dock, for the Fish Meal Co., Ltd.; mission room, Peel Road, for Rev. H. A. N. de J. Lovell; offices, London Road South, for R. Lancaster and Sons.

FOREST ROW (Sussex).—Schools at Ashurst Wood; F. J. Wood, county surveyor, County Hall, Lewes.

FROME.—Sewage disposal scheme for the U.D.C (£7,000).

GLOUCESTER.—New Wesleyan Methodist mission hall in Bristol Road district (£4,000). School (£9,000); J. Trew, Station Chambers, Gloucester.

GORTON (Manchester).—Rectory, &c., St Mark's Church, for Rev. J. Smith.

GT. STANMORE.—Bank and house, and four shops, Church Road, for the London and South-Western Banking Co.; J. Liscombe, manager, 170, Fenchurch Street, E.C.

GREAT HOUGHTON (near Barnsley).—Eight houses, for M. Noble.

GULLANE (N.B.).—New hotel.

HALIFAX.—Skating rink, for the American Roller Skating Rink Co., Ltd.; R. Horsfall & Co., architects, Halifax.

HASTINGS.—Pair of semi-detached villa residences, Bury Road, Silverhill; G. Fryer, builder and architect, Hastings. Alterations to premises, 15 and 17, Hughenden Road, for W. H. Festing; G. Fryer, builder and architect. Additions, Keena House, Lower Park Road, for G. Carr; Murray & Co., builders, Hastings.

HEMEL HEMPSTEAD.—School on the Woodman site; L. Smeathman, clerk to the R.D.C.

HERNE BAY.—Houses, Spencer Road, for P. E. Iggulden, and Grand Drive, West Cliff, for J. Budd; H. Pettman, architect, 15, High Street, Herne Bay.

HIGH LITTLETON (near Bristol).—Chapel for the Primitive Methodist Society; G. H. Gibson, architect, Victoria Square, Radstock, near Bath.

HINDLEY (Lancs.).—Extensions to Hindley Green Mills, for Thos. Kirkpatrick & Sons. Houses, Pennington Street, for the Co-operative Society.

HIGH WYCOMBE.—Stabling and stores, Baker Street, for W. C. Loosley. House, Clarendon Road, for A. W. Keen.

HORWICH.—Extensions at W. T. Taylor & Co.'s Victoria Mills; W. Makinson and Son, contractors, Horwich.

HOUNSLOW.—Chapel at Cemetery (£700); N. Parr, surveyor to Brentford U.D.C.

HUDDERSFIELD.—Warehouse, &c., Barge Street, Deadwaters, for the Industrial Society, Ltd.; J. Berry, architect, 3, Market Place. New schools for the T.C. (£12,000).

HULL.—Probable reinstatement, after fire, of portion of premises of G. Platts, cabinet maker, Trippett Street.

ILFRACOMBE.—Seven lock-up shops, The Promenade; A. Hussell, architect, Market Square, Ilfracombe. Nine lock-up shops and three dwelling houses in High Street; F. C. Horwood, architect, High Street, Ilfracombe.

ILLINGWORTH (near Halifax).—New Liberal Club premises, Keighley Road (£700).

INCE.—Houses, Gordon Street, Clarington Brook, for H. Dickinson. Alterations and additions to St. Mary's Schools, Lower Ince.

IRCHESTER (near Wellingborough).—Additions to the Chrome Leather Dressing Works, Little Irchester.

KIDDERMINSTER.—Weaving shed, Mill Street, for J. Humphries & Sons, Ltd. Rebuilding Noah's Ark Inn, for J. Amyes.

KINGSTON-ON-THAMES.—Alterations to business premises, 51, Kingston Hill, for A. B. Archard.

KIRKWALL.—Proposed restoration of St. Magnus Cathedral; Mr. Watson, architect.

KNEBWORTH (near Stevenage, Herts.).—Six bungalows, for G. F. Bentley.

KNOWLE (near Bristol).—Roman Catholic Church (£4,500); Pergin and Pergin, architects, London; Stephens, Bastow & Co., builders, Bristol.

LEIGH-ON-SEA (Essex).—Engine and exhauster house at the Gasworks, for the U.D.C.; J. W. Liversedge, engineer, Council offices, Leigh-on-Sea.

LEPTON (Yorks.).—Fireworks factory, Rowley Hill, for H. Kilner.

LITTLEBOROUGH.—Public conveniences in Halifax Road; Surveyor, Council offices, Littleborough.

LITTLEHAMPTON.—Public Shelter Hall for the U.D.C. (£1,500); H. Howard, surveyor.

LIVERPOOL.—Technical Institute at Garston (£8,000); Corporation.

LLANDEWI BREFI (Cardigan).—Additions to St. David's Church; W. D. Caröe, architect, Little College Street, S.W.

LOFTUS.—Semi-detached houses, West Road, for Wilcox & Hebditch.

LONDON (BATTERSEA, S.W.).—Extensions to the Polytechnic, in Forfar Road; Mountford & Clapham, architects, Norwich House, Southampton Street, W.C.

(WHITECHAPEL, E.).—Re-erection of 38, Spital Square; Tasker and Wright, architects, 43, Penton Street, Pentonville, N. Addition to the London Hospital Medical College, Turner Street, for the Governors.

(LONDON FIELDS, N.E.).—Meeting hall in Tower Street; T. Gates and Sons

(W.).—Alterations to stage and arena at the Hippodrome, Cranbourne Street; F. Matcham & Co., architects, 9, Warwick Court, High Holborn, W.C. Addition to the Marble Arch Hotel, Oxford Street; D. Joseph, architect, Portland House, Basinghall Street, E.C. Proposed restaurant in Gerrard and Wardour Streets; E. J. W. Hider, architect, 8, Clifford's Inn, E.C. Rebuilding 193-197, Regent Street; Allen & Co., builders, Pimlico Wharf, Westminster.

(TOTTENHAM, N.).—Large furnishing stores, Seven Sisters Corner, for Messrs. Ward.

(BARKING, E.).—Police station (£9,660); J. D. Butler, surveyor, New Scotland Yard, S.W. Extension of factory, Abbey Works, for W. Warne & Co. Additions to cooperage and to benzine house at factory of the London Butchers' Hide and Skin Co., River Road. Proposed additions to works of Gross, Sherwood & Heald, Ltd., Jenkins Lane.

(LEWISHAM, S.E.).—Roman Catholic Church, High Street; Kelly and Dickie, architects, Oxford Street, W.; Bradford & Co., builders, Leicester. Five houses, Thornwood Road; W. J. Scudamore and Sons, builders, 13, Manor Lane, S.E. Electric theatre, Langley Road; J. Watt, builder, The Lodge, Bromley Road, S.E. Two houses, St. Fillans Road, and four houses, Brownhill Road; Norfolk & Prior, architects, 2, Station Buildings, Catford Bridge, S.E. Two houses, Farley Road; J. Laird, builder, 13, Berlin Road, Catford, S.E. Four houses, Garthorne Road; Dunsmore Bros., estate agents, Honor Oak Park, Sydenham.

(MARYLEBONE, W.).—New depôt buildings in Grove Road; J. P. Waddington, Borough Surveyor, Town Hall, Marylebone Lane, W.

(E.).—Addition to 50, Stepney Green; A. D. Sturley.

(CLAPHAM, S.W.).—Lock-up shops in Hazelbourne Road; W. N. Gould.

(STREATHAM, S.W.).—Four houses, Mitcham Lane, and five houses, Babington Road; G. W. Pearce.

(BERMONDSEY, S.E.).—Extension of classrooms at United Methodist Sunday School, Rosebery Street. Three shops, Tower Bridge Road; Thompson Bros., builders, 151, Queen's Road, S.E.

(ST. PANCRAS, N.W.).—Shops, Stanhope Terrace; A. Whitelaw, North-Western Railway Co., Euston. Buildings, 202 to 214, Euston Road; G. Vernon, architect, 6, Mortimer Street, W.

(WEST HAM, E.).—Mixing house at premises of R. Ingham, Clarke and Co., West Ham Abbey; W. Gladding & Co., builders, 188, Whitechapel Road, E. Alterations and additions, 382, Green Street, Upton Park, for Lipton, Ltd.

(SILVERTOWN, E.).—Offices and stables at J. Knight & Sons' premises, Knight's Road and Bradfield Road; J. G. Harlock & Son, builders, Barking Road, E.

(STRATFORD, E.).—Gun sheds, &c., at the Artillery House, The Green, Stratford.

(PUTNEY, S.W.).—Club room, &c., at the Spencer Arms public house, Lower Richmond Road; R. T. Hughes & Co., Ltd. Bank of England record office and other buildings, Priory Lane; J. C. Radford, architect, 223, Upper Richmond Road, S.W.

(BETHNAL GREEN, N.E.).—Municipal buildings in Cambridge Road; E. E. Finch, surveyor to the Borough Council.

(HACKNEY, N.E.).—Extension of mains to supply premises of Rigby, Battock & Co., Muston Road, Libstein & Co., 16a, Triangle Road, and Neville, Kaye & Co., 2a, Sigdon Road.

(CHELSEA, S.W.).—Buildings in Manor Street; Wills & Anderson, architects, 24, Bloomsbury Square, W.C.

(SOUTH KENSINGTON, S.W.).—Building in Holland Park Avenue and Lorne Gardens, for C. P. Crawford.

(PADDINGTON, W.).—Buildings in Biddulph and Ashworth Roads, for the General Motor-Cab Co., Ltd.

(ADELPHI, W.C.).—Proposed adaptation of premises in John Street and Durham House Street for concert hall (accommodate 500); Hayward and Maynard, architects, 20, John Street, W.C.

(STEPNEY, E.).—Alterations to the King's Hall, Commercial Road, for cinematograph entertainments; M. S. Ward, architect, 100, Victoria Street, S.W.

(WOOLWICH, S.E.).—Thee new hostels at the L.C.C. Training College, Avery Hill.

(SOUTHFIELDS, S.W.).—Five houses, with shops, in Wimbledon Park Road; F. W. D. Johnson.

(MILL HILL, N.W.).—Repairs to Mill Hill School, after fire.

(DEPTFORD, S.E.).—Additions to premises in Hanlon Street, for A. G. Scott & Co.

(RAYNES PARK, S.W.).—Pair of villas (£460); R. B. Rowell, architect, Triangle Corner, East Sheen; A. Judson, builder, Hanwell.

(WESTMINSTER, S.W.).—Block of offices, &c., Parker Street and Princes Street; Drivers, Jonas & Co., estate agents, 23, Pall Mall, S.W.

(LAMBETH, S.E.).—Eight houses, Chester Street; J. Appleby & Son, builder, Cornwall Works, Southwark Park, S.E. Warehouse, offices and stabling rear 67 and 69, Upper Kennington Lane; J. A. J. Woodward & Sons, architects, 69, Kennington Oval, S.E.

(W.C.).—Building, corner of Exeter Street and Catherine Street; G. H. Fox, architect, 9, John Street, W.C.

(WIMBLEDON, S.W.).—Factory for explosives, Ravensbury Road, for the British Incandescent Mantle Works, Ltd.

LOUGHBOROUGH.—Repairs, after fire, at Watson & Co.'s Joinery Works, Nottingham Road.

LUTON.—Probable reinstatement, after fire, of premises, Bute Street, occupied by Giddings & Wright, hat manufacturers; Neville & Sons, contractors, Luton, owners.

MANSFIELD.—Three houses, Blind Lane; A. E. King, architect, Bishop's Chambers, Mansfield. Horse and Jockey Inn, Leeming Street, to be rebuilt, for Hole & Co., brewers, Newark; F. P. Cook, architect. Business premises, Church Street, for Blake & Beeley, ironmongers.

MARGATE.—Houses, Windsor Avenue, for F. Miles, Surrey Road (Reeve and Reeve, architects, Margate); Addiscombe Road, for C. E. Doughty.

MARKET RASEN.—Cemetery buildings, Legsby Road; S. E. Kendall, architect to the U.D.C., 2, Mill Street, Market Rasen.

MATLOCK BATH.—Kursaal, theatre and restaurant; surveyor, Council Offices, Matlock Bath.

MIDDLESBROUGH.—New Primitive Methodist Church and Schools.

MYNYDDISLWYN (GLAM.).—Forty houses, at Penmaen, for the Oakdale Building Club; four houses and two shops, at Wattsville, for Mr. Thorne.

NEWCASTLE.—Alterations and additions to Westmorland Road Council School; A. C. Coffin, secretary, Education Offices, Northumberland Road, Newcastle.

NEWCASTLE-UNDER-LYME.—New Wesleyan Sunday Schools.

NORTHFLEET.—Houses, Perry Street, for T. W. Box, builder, 2 and 4, Pelham Road South, Gravesend.

NORTON.—Additions to St. Nicholas Church; W. Millard, architect, 10, Gray's Inn Square, W.C.

NORWICH.—New roller skating rink; Boulton & Paul, Ltd., Rose Lane, Norwich.

NUNEATON.—Additions to Council Offices; F. C. Cook, Nuneaton.

OTHERY.—Alterations to Council School; C. H. Bothamley, Weston-super-Mare.

OTTERY ST. MARY (DEVON).—County school for boys, and head master's and boarders' house (£6,500).

PARTICK.—New church and hall (£4,000); Clerk to Trustees, Congregational Church, Partick.

PENDLETON.—New church, St. Ambrose (£7,500); vicarage to follow.

PICKERING.—Proposed new Liberal Club premises.

PITSEA.—School (£1,500); F. Whitmore, architect, 73, Duke Street, Chelmsford.

PLYMOUTH.—Extension of Emmanuel Church Baptist Sunday School, North Road (£1,000).

PONTARDULAIS.—New schoolroom in connection with Hope Congregational Church.

PONTEFRACT.—Sunday schools in connection with North Featherstone Primitive Methodist Church (£1,500).

PONTELAND.—School (£4,000); W. Forest, Moot Hall, Newcastle-on-Tyne.

PONTYPRIDD.—Premises in Rickards Street, for W. Hancock & Co., Ltd. Teather & Wilson, architects, Andrews Buildings, Queen Street, Pontypridd. Twenty houses (£217 per house); E. Rees, architect, Alexandra Chambers, Pontypridd; R. Jones, builder, Corrunna Road, Pontypridd.

PORTSMOUTH.—House, Mayfield Road; W. Mitchell, The Laurels, London Road, Portsmouth. Two shops, Elm Grove; S. Smith, 2, Albert Grove, Southsea. Stores, Hambrook Street; Long & Co. Motor garage, Havelock Road; J. D. Ashworth, 21, Havelock Road, Southsea. Two houses, Devonshire Avenue; F. J. Waight, Fawcett House, Devonshire Avenue, Southsea.

PORT TALBOT.—Rebuilding Jersey Marine Hotel; F. Smith, Port Talbot.

PRESTWICH.—Refuse destructor; S. Morgan, architect, Prestwich.

REDCAR.—Alterations to premises, 15, High Street, for Mrs. Tate; Brentnall and Crosby, architects, 21, Dovecot Street, Stockton-on-Tees.

REPTON.—Water supply scheme for Ashby-de-la-Zouch and Swadlincote U.D.C. (£8,000).

RICHMOND-ON-THAMES.—Warehouse, 63, Kew Road, for Brewer, Smith and Brewer. Additions to Redholme, Queen's Road; E. J. Partridge, architect, 39, George Street. Additions to 251, Sandycombe Road; Boroughs & Dixon, builders, 231, Sandycombe Road.

ROCHDALE.—Extensions at gasworks; Borough engineer.

RUGBY.—House and shop at Dunchurch, for the Rugby Co-operative Society.

SADDLEWORTH.—County School (£3,000).

ST. ALBANS.—Proposed Roman Catholic day school. Two villas, for T. Yates, Blandford Road.

ST. IVES.—Twenty-seven houses, Trelyon; Mr. Bolitho, builder.

ST. KEVERNE (CORNWALL).—Eighteen houses, for Col. Lees, manager Porthonstock quarries.

ST. LEONARDS.—Alterations and additions to the Pier; The Manager, St. Leonards Pier.

SALFORD.—New infants' school in Nashville Street (£2,500); Director of Education, Salford. New school (£4,847); J. Byrom, Ltd., builders, Woolfold, Bury.

SALISBURY.—Church; E. D. Webb, The Gateway, Salisbury.

SEAHAM HARBOUR.—Additions to school (£4,000); F. Coates, Durham.

SEFTON (near LIVERPOOL).—Restoration of the Parish Church (£5,000); Rev. H. M. Wells, M.A., Vicar.

SHERWOOD.—School, Haydn Road (£8,587); Wm. Crane, Ltd., builders, Nottingham.

SHREWSBURY.—High school for girls (£8,000); E. C. Peele, secretary, Shropshire Education Committee, Shrewsbury.

SKERTON (LANCS.).—New Wesleyan Church (£5,000); S. Wright, architect, Morecambe.

SKIPTON.—Stables and depôt; A. E. W. Aldridge, surveyor, Skipton.

SMETHWICK.—Fourteen houses, Clarendon Road, for F. F. Strong; six in Clarendon Road, for W. Corson; fourteen in Annesley Road, for F. W. G. Sayce. Additions at depôt, stables, stores, &c.; C. J. Fox-Allin, surveyor, Town Hall, Smethwick.

SOUTH ELMSALL (near DONCASTER).—Houses and shops, for S. Street.

SOUTHEND.—Skating rink, Southchurch Road (£7,000); Cabuche & Haywood, architects. Additions to laundry, Eastwood Road, for the Albany Electric Laundry. Boarding house, Pembury Road, for Mrs. Morrish. Conversion of houses into shops, Leigh Road East, for Mrs. Light. Clubhouse (£2,000); Secretary, Crowstone Yacht Club, Southend-on-Sea.

SOUTH KIRKBY (near WAKEFIELD).—Ten houses, for Ellis & Robinson. Four houses, for J. E. Morton, Purston.

SOUTHPORT.—New theatre and music hall projected.

SOUTH SHIELDS.—House and stabling, Berkley Street, for J. D. Martin J. E. Stout, architect, King Street, South Shields. Extension to workshops, Smith Street, Tyne Dock, for J. Marshall & Co.; J. Rennoldson, architect, King Street. Alterations to Grapes Hotel, Market Place, for R. Deuchar, Ltd.; T. A. Page & Son, architects, King Street. Extension to shipyard offices, for J. Readhead and Sons, Ltd. Houses, Dean Lane and St. Mary's Terrace, for G. Thornton & Co.; J. H. Morton, architect, King Street.

STANFORD-LE-HOPE (ESSEX).—Schools (528 children); C. M. Shiner, architect, 10, John Street, Adelphi, W.C.

STAPLEFORD.—Mission Church, St. Helen (£1,250), for the Rev. J. Holroyde.

STOCKTON-ON-TEES.—Mission Church, Appleton Road, for Rev. F. S. Willoughby; presbytery, Spring Street, for Rev. J. P. Byrne.

SUTTON-IN-ASHFIELD.—County school; E. P. Hooley, Shire Hall, Nottingham.

SUTTON MALLET.—New class room at Council School; C. H. Bothamley, Weston-super-Mare.

TAYPORT (FIFE).—Moulding shop, for J. Ferguson, ironfounder, Tay Street.

TONBRIDGE.—Additions to workhouse (£430); S. Philpot, architect, 65, High Street, Tunbridge Wells; Punnett & Sons, builders, Tonbridge.

TREFDRAETH.—School (£1,375); J. Owen, architect, Menai Bridge; O. W. and T. Rowlands, builders, Rhosneigr.

TRURO.—Restoration, St. Ermes Church; E. Sedding, architect, Bank Chambers, Wadebridge.

WARRINGTON.—Proposed new Baptist Church and schools, Golborne Street (£3,000).

WARWICK.—Houses, Paradise Street, for A. & J. Chaplin, builders, 52, Smith Street.

WATFORD.—New house, for Rev. J. Thomas, Leavesden Road; new stores and stables, Aldenham Road, for J. Rodwell; schoolroom, 85, Cassio Road, for B. C. Apps.

WAWNE (near HULL).—New school for the East Riding of Yorks. C.C. Building surveyor, County Hall, Beverley.

WELLINGBOROUGH.—Alterations to house and bakery, Havelock Street and Herriott's Lane; Talbot, Brown & Fisher, architects, Wellingborough.

WESTHOUGHTON (LANCS.).—Houses in Wingates; Cooper & Hodgkinson Church Street, Westhoughton.

WEYMOUTH.—Hotel; Crickmay & Sons, architects, 13, Victoria Street, S.W.

WHINNEY [illegible]

WICKFORD (Essex).—Bank premises, High Street, for Barclay & Co.
WOMBWELL (Yorks).—Houses, eight, in Park Street, for F. B. Ward & Son; four in Everill Gate Lane, for C. Broadbent.
WYMONDHAM (Norfolk).—New Baptist Church; A. F. Scott, architect, 24, Castle Meadow, Norwich.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, March 26th. At 8 p.m. At the King's Hall, Holborn Restaurant. Last smoking concert of the season.

Physical Society.—Friday, March 26th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "The Production of Steady Oscillations in Closed Circuits, and a Method of Testing Radio-Telegraphic Receivers," by Prof. J. A. Fleming; and "The Effect of an Air Blast upon the Spark Discharge of a Condenser Charged by an Induction Coil or Transformer," by Prof. J. A. Fleming and Mr. H. W. Richardson.

Royal Institution.—Saturday, March 27th.—At 3 p.m. Lecture on "The Properties of Matter," by Prof. Sir J. J. Thomson. (Lecture V.)

Friday, April 2nd. At 9 p.m. Discourse on "Electrical Striations," by Prof. Sir J. J. Thomson.

Association of Engineers-in-Charge.—Saturday, March 27th. Annual dinner.

Junior Institution of Engineers.—Saturday, March 27th.—At 3 p.m. Visit for the inspection of the electrification plant of the South London line of the L.B. and S.C. Railway.

Royal Society of Arts.—Monday, March 29th. At 8 p.m. Cantor lecture on "Steam Turbines," by Mr. G. G. Stoney. (Lecture II.)

Electrical Trades Benevolent Institution.—Tuesday, March 30th. At 7 p.m. At the Whitehall Rooms, Hotel Metropole. Dinner.

Liverpool and District Electrical Association.—Tuesday. March 30th. At 8 p.m. At the Common Hall, Hackins Hey, Liverpool. Discussion on "Arc Lamps."

Faraday Society.—Tuesday, March 30th. At 8.0 p.m. At the Library of the I.E.E. Papers on "The Electro-Analysis of Mercury Compounds with a Gold Cathode," by Mr. F. Mollwo Perkin; "The Relation between Composition and Conductivity in Solutions of Meta- and Ortho-Phosphoric Acids," by Mr. E. B. R. Prideaux; "A New Electrical Hardening Furnace," by Messrs E. Sabersky and E. Adler; and "Experiments on the Current- and Energy-Efficiencies of the Fin'ay Alkali Chlorine Cell," by Mr. F. G. Donnan.

Institution of Electrical Engineers (London).—Thursday, April 1st. At 8 p.m. At the Institution of Civil Engineers. Adjourned discussion on Mr. J. H. Rider's paper on "The Electrical System of the L.C.C. Tramways," or paper on "The Theory and Application of Motor Converters," by Mr. H. S. Hallo.

Rontgen Society.—Thursday, April 1st. At 8.15 p.m. At 20, Hanover Square, W. Paper on "The Origin, History and Development of the X-Ray Tube," by Mr. J. H. Gardiner.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, March 29th.—"A" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 9.30 p.m.

Tuesday, March 30th.—"B" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 9.30 p.m.

Thursday, April 1st.—"C" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 9.30 p.m.

Friday, April 2nd.—"D" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 9.30 p.m.

(Signed) J. H. S. Phillips,
Capt. and Acting Adjutant.

INQUIRY COLUMN.

[Replies should be accompanied by stamped envelopes ready for retransmission to our correspondents.]

The following are asked for:—

Selenium and Selenium Cells; Climax glow lamps; castings lined with English vitreous enamel.

"Dynolite" ignition accumulator, and "Orilux" officer's light for signalling purposes.

Catalogue Standardisation.—We have received from Mr. J. D. Barton Innes, of Craven House, Kingsway, W.C., a prospectus of the Engineers' Standardised Publications Association, of which he is the secretary, explaining that the object of its formation is to effect a much needed reform in regard to the standardisation and classification of manufacturers' price lists, catalogues, &c. It is desired to commence operations with 250 subscribers of 1 guinea each. The Advisory Committee consists of Messrs. A. H. Dykes, T. W. How, H. M. Sayers and W. H. Booth, with Mr. John I. Hall as technical manager.

NOTES.

Judgment in the Electro-Peat Case.—Yesterday morning judgment was entered for the plaintiff against Simpson for £910 and costs, and for the other defendants with costs.

Electrical Trades Benevolent Institution Festival, March 30th.—Mr. W. Davenport, the secretary, sends us the following information with regard to the above: "The first returns of the collection forms show very satisfactory amounts for announcement, contributed by a wide circle of sympathisers. There is a substantial sum to come to the funds from the proceeds of the recent successful Manchester Electrical Exhibition. It is desirable that all further applications for dinner tickets should be sent at once to the secretary, at Ridler Place, Holland Street, Blackfriars, S.E. The whole of the arrangements are well in hand, and a pleasant and successful gathering is anticipated."

Electrical Contractors' Association (Liverpool Branch).—The annual smoking concert and supper of this branch was held on Thursday, March 4th, at the St. George's Restaurant, Liverpool. The chairman of the branch (Mr. Wesley Sutton) was present, supported by Mr. J. McDermott, J.P., Mr. W. A. Shaw, Mr. A. W. Ross, Mr. B. E. Roberts, and the whole of the officers of the branch, the total number present being over 70, or nearly double the attendance at last year's function. Mr. C. J. Harford, A.M.I.E.E., proposed "The Association." He outlined its history up to date, and mentioned that he had received very good news respecting the Association's agreement with the Cable-Makers' Association—namely, that although the total amount of purchases by the members of the E.C.A. had fallen slightly below the minimum amount arranged from August 10th, 1907, to December 31st, 1908, the C.M.A. had decided to allow the special rebate. The toast was responded to by Mr. J. McDermott, J.P., who, in a very enthusiastic and optimistic speech, stated that the Central Board hoped shortly to have an agreement drawn up with the storage battery makers. Mr. H. H. Hinson proposed "The Chairman of the Liverpool Branch," and Mr. Sutton, in responding, referred to the improved good attendance at the monthly meetings, and expressed his pleasure that more of the members were now taking an active interest in the branch. "The Electrical Manufacturers" was proposed by Mr. S. Lord, and was responded to by Mr. Wooler (Messrs. W. T. Glover & Co., Ltd.). Mr. C. R. Whipple, A.M.I.E.E., in proposing the toast of "The Visitors," mentioned in particular the names of two gentlemen, Mr. A. W. Ross (hon. solicitor) and Mr. B. E. Roberts, who had given very valuable help in the inauguration of the Workmen's Registration Bureau, which was now working with such great success. In responding, Mr. Roberts detailed the working of the Bureau, pointing out that the members of the branch could now have efficient workmen supplied to them immediately on application without any expense whatever. He also emphasised the necessity of all the members notifying him immediately they took into employment, or discharged, any man. The musical programme included a contribution by Mr. C. R. Whipple, in the shape of a parody of his own composition on "The Village Blacksmith," entitled "Our Chairman."

Single-Phase Working in Austria.—It is announced from Prague that the Oerlikon Maschinenfabrik, of Zurich, has concluded an agreement with the Prague Electricity Co., formerly Kolben & Co., whereby the latter has acquired the exclusive rights to utilise in Austria-Hungary the system and experience of the Zurich company in connection with the working of electric railways on the single-phase method. It is added that the Prague company proposes to pay 5½ per cent. for 1908, or the same rate of dividend as in the previous year.

National Physical Laboratory.—The annual inspection of the National Physical Laboratory took place on Friday last, the visitors being received by Sir Archibald Geikie, P.R.S., chairman of the General Board. Among the new features of the equipment were an electric furnace designed by Messrs. Harker and Price, in which the heating element consists of a helix cut out of a solid tube of Acheson graphite, and electrically-heated water baths for testing large numbers of mercury thermometers rapidly; Mr. Archibald Campbell's new apparatus for measuring capacity and inductance at high frequencies; an apparatus for testing the speed of photographic shutters; various new apparatus in the Electrotechnics Laboratories, including a 100,000-volt 20-kw. transformer, an electrical oven for breakdown tests at various temperatures, Siemens double alternator, water-tube resistances for heavy currents with potential leads corrected for inductance, apparatus for photometric and life tests on glow lamps, &c.; a horizontal machine for testing wire specimens in a water bath 50 ft. long; and a variety of research apparatus in the metallurgical and other departments. We shall review the Report more fully in a later issue.

British Exhibition Commissioners.—His Majesty the King has appointed Exhibition Commissioners to watch over the subject of British representation at a number of forthcoming Exhibitions, including Brussels 1910, Rome 1911, and Turin 1911, and to assist the Board of Trade in organising British exhibits. The Commissioners include Sir Wm. Mather, Sir R. A. Hadfield, Mr. W. J. Crossley, Dr. R. T. Glazebrook, and Mr. G. Marconi.

(*Continued on page* 524.)

Electric Tramways and Lighting in Para.

The city of Pará, Brazil, is located on a plain having an elevation of about 50 ft. above the Pará River, the ground sloping to the river front. The city is situated at a point distant about 120 miles from the mouth of the Amazon River, which here is about 60 miles wide, but it obstructed by hundreds of islands. The only reliable channel for steamer traffic is known as the Pará channel, and on this account, the entire traffic of 20,000 miles of navigable rivers in the Amazon district must pass through this channel. Large ocean steamers are able to anchor within one mile of the present docks, while all the smaller steamers, of which there are a large number, can come in and moor alongside.

The population at the present time may be taken as being about 150,000.

The old part of the city has very narrow streets; but the newer part has wide streets, most of which are lined with trees.

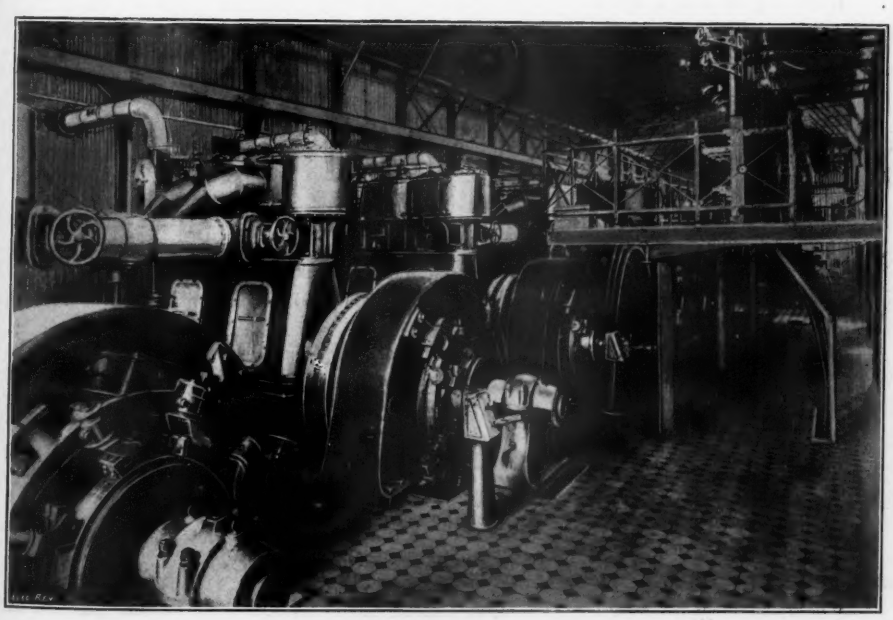
The tramways, which were formerly operated by mules, had an extent of 33 miles of single track, all owned by one company called the "Urbana Co.," although portions were laid to different gauges. The electric lighting was supplied by two companies, the Urbana Co. furnishing all the public and also commercial lighting, and the Paraense Co. furnishing private lighting only.

In the year 1905 a concession was obtained for a period of 99 years for the purpose of electrifying the tramways. This concession and the old mule tramways were purchased by the Pará Electric Railways and Lighting Co., Ltd., of London, and a contract awarded to Messrs. J. G. White & Co., Ltd., for the complete reconstruction and installation of the tramways and lighting.

The total length of track constructed for electric working is 55,060 metres, of which 26,000 metres of single track are laid in paved streets, and 21,600 in unpaved streets, all with girder rails. A further 7,400 metres of single track were laid in unpaved streets with 70-lb. T-rails made to B.S. specification. Sleeper construction was employed throughout the whole of the work, with rails of 90 lb. to 96 lb. per yard, Thermit jointed, on paved streets. On unpaved streets continuous joints were employed. The track is laid to a gauge of 4 ft. 8½ in.; and all the girder rails were supplied by the North-Eastern Steel Co., of Middlesbrough.

The sleepers, which are made from a very hard Brazilian wood, called "Massaranduba," are spaced 2 ft. 6 in. from centre to centre, and rest on stone ballast, which is brought up to the level of the top of the sleepers in all paved streets. In unpaved streets the sleepers rest on the same depth of ballast, but the latter is brought to the level of the head of the rail and well rammed.

Avenida 16 de Novembro, Para.



Interior of the Power House, Para.

The granite setts used were shipped from Lisbon.

All the special work used in the track was manufactured by Messrs. Hadfield's Steel Foundry Co.

As stated before, the ground upon which the city stands is practically level, but there is one short gradient of 1 in 56. The smallest curve on the whole of the work is of 10 metres radius.

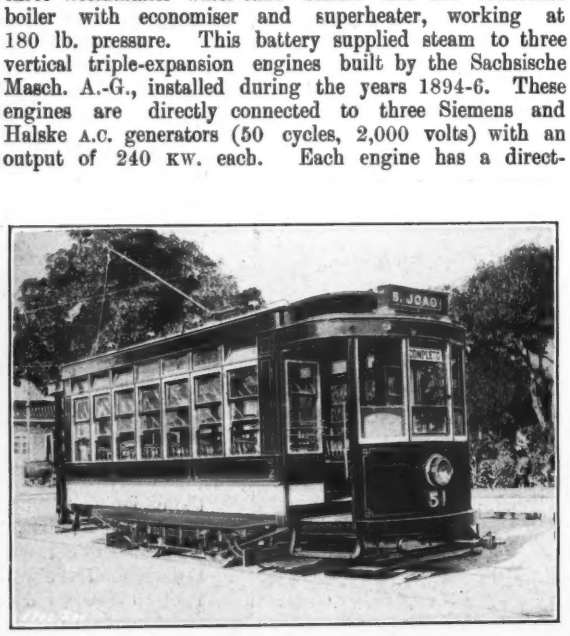
With the exception of 4 km. of centre poles and 3 km. of side bracket construction, the whole of the overhead work consists of span construction. Tubular steel poles are employed throughout; of these there were at the beginning of the work about 1,400 in the city, which were used for carrying the lighting wires, and, where possible, advantage was taken of their presence for the purpose of carrying the overhead work for the tramways. In addition to these, a

further 1,350 poles were supplied by Messrs Stewarts & Lloyds. The feeder and section boxes were furnished by Messrs. Estler Bros.; the trolley wire, which is of No. 00 B. & S. grooved type, supplied by Messrs. W. F. Dennis & Co. and the National Conduit and Cable Co., is divided by section insulators into 1,000-metre lengths, for the purpose of isolation in the case of breakdown. The cables which carry the current to the overhead lines are about 12 miles in length, suspended from toggle insulators on channel-iron cross arms, erected on the poles above the spans and brackets. These cables are stranded, of three sizes—viz., ·55 sq. in., ·45 sq. in. and ·33 sq in., and are twin braided.

The power house, located on the south side of the River Guajara, is a substantial steel-framed building, with a brick chimney, 45 metres high. Coal is loaded direct, by means of a 10-ton crane, from lighters lying alongside into derrick trucks, which are then run and tipped into the boiler house, or the coal is stacked in a yard provided for this purpose.

Tramway Construction in the Streets of Para.

The old equipment consisted of three Steinmuller water-tube boilers and one Belleville boiler with economiser and superheater, working at 180 lb. pressure. This battery supplied steam to three vertical triple-expansion engines built by the Sachsische Masch. A.-G., installed during the years 1894-6. These engines are directly connected to three Siemens and Halske A.C. generators (50 cycles, 2,000 volts) with an output of 240 KW. each. Each engine has a direct-connected exciter. There is also one vertical compound Belfort engine of French manufacture, installed in 1898, direct connected to a Société Alsacienne single-phase generator (50 cycles, 2,000 volts) with a direct-connected exciter.



Standard Electric Car, Para Tramways.

The above plant was used for supplying private and public lighting.

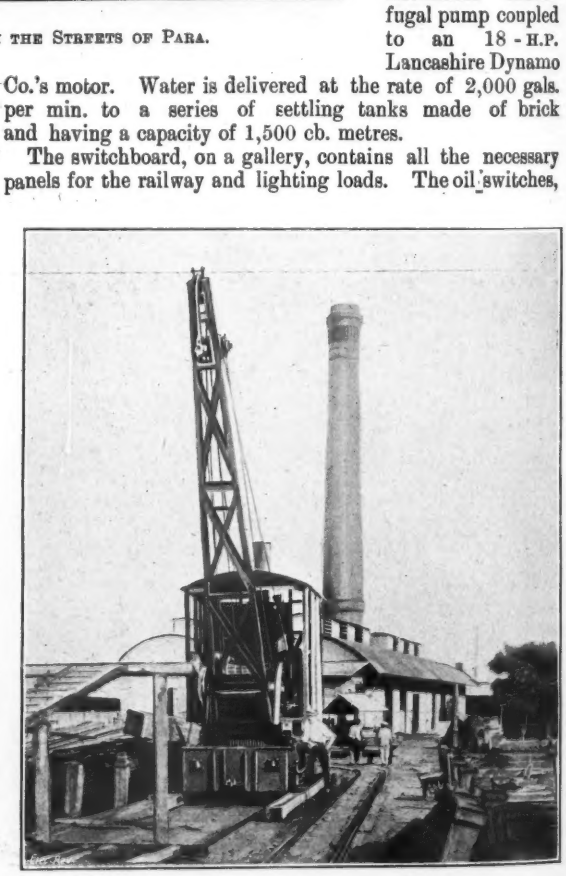
The new equipment consists of four Babcock & Wilcox marine-type boilers, each capable of evaporating 10,000 lb. of water into steam at 180 lb. pressure. Each boiler is fitted with an integral superheater capable of raising the temperature of the steam to 500° F.

There are three sets of steam-driven cross-compound air-pumps with jet condensers, supplied by the Worthington Pump Co.; also two 5,000-gallons per hour capacity horizontal boiler feed pumps, a feed heater and Paterson purifier.

This plant supplies steam to three triple-expansion three-crank Belliss engines, each of 585 B.H.P., coupled to three 400-KW. compound-wound Dick, Kerr direct-current generators. There are also two similar Belliss engines, coupled to E.C.C. single-phase generators of the revolving field type, working at 2,200 volts, 50 cycles. The steam consumptions per B.H.P. guaranteed are as follows: — 25 per cent. over-load, 14 lb.; full load, 13·5 lb.; ¾ load, 13·5 lb.; and ½ load, 14 lb. A 40-B.H.P. Belliss-E.C.C. 125-volt exciter set has also been installed.

Formerly there was a separately driven steam pump for pumping the water from the river for the boilers and for condensing purposes. In its place has been installed one 10-in. Invincible centrifugal pump coupled to an 18-H.P. Lancashire Dynamo Co.'s motor. Water is delivered at the rate of 2,000 gals. per min. to a series of settling tanks made of brick and having a capacity of 1,500 cb. metres.

The switchboard, on a gallery, contains all the necessary panels for the railway and lighting loads. The oil switches, isolating switches and lightning arresters are supported on the underframe of the gallery; the whole of the switchboards were supplied by Messrs. Ferranti, Ltd.



Power House and Wharf, Para.

The car-shed is steel framed and covered with corrugated iron throughout; it contains ten tracks, six of which have a pit running half the length of the shed. There are

ten tracks running into the shed on the south side, and five on the north, so that shunting is facilitated; a carpenters' shop, with a capacity for eight cars, a paint shop for six cars, also electrical, machine and smith shops, fitted with the latest tramway and shop tools, are provided.

The cars are of four different types, 70 in number, and include :—Combined luggage and second class vestibule open cars : by the Brush Co., 3 ; United Electric Car Co., 6.

First-class open vestibule cars : by the Brush Co., 1 ; United Electric Car Co., 23.

Second-class vestibule open cars : by the J. G. Brill Co., 1 ; Brush Co., 20 ; also 14 first-class double service cars supplied by the United Electric Car Co.

In addition to these, there are two "palace" cars, built by the United Electric Car Co., lavishly upholstered and fitted with mahogany tables and swinging armchairs, which were furnished and decorated by Messrs. Waring & Gillow ; one of these cars is intended for the use of the Governor, and the other for the use of the Mayor of Pará.

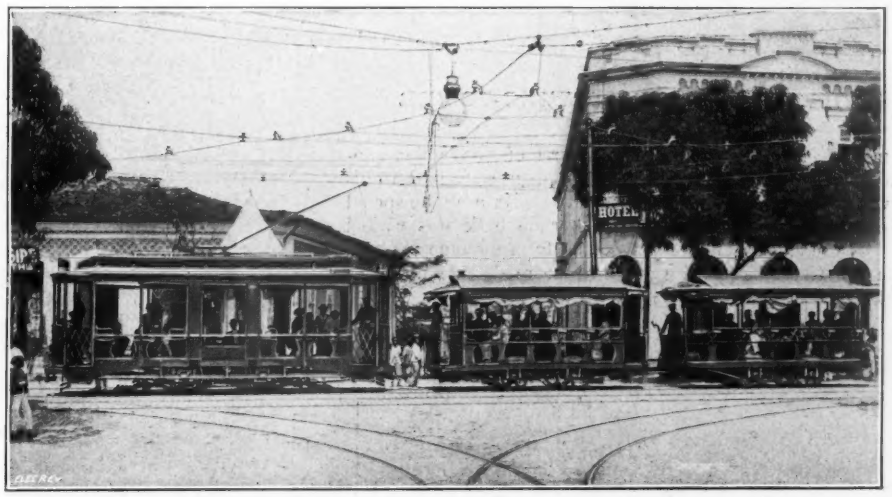
The trucks, all supplied by the Brill Co., have 6 ft. wheel bases, except in the case of the palace cars, which have a wheel base of 7 ft.

The electrical equipments were supplied by the G.E. Co., of New York. Each car is equipped with two 40-H.P. motors for 500 volts, controllers, magnetic blow-out, circuit-breaker, &c. ; each car is also fitted with a Hudson & Bowring lifeguard. The ordinary double service cars have a length, including platform, of 26 ft. 6 in., and the vestibule open cars, a length including platform of 26 ft. 2 in.

At present the high-tension lighting circuits are all run overhead, the pressure of 2,200 volts being transformed down to 120, by means of transformers fixed on the poles. All the high-tension lay-out has now been put underground.

The total length of cable laid is approximately 14½ miles, supplied by Messrs. Callender, and is of the concentric type. The cables were made for a working pressure of 2,200 volts, and when actually laid in Pará withstood satisfactorily 4,000 volts for 30 minutes between conductors and 1,000 volts for 30 minutes between outer conductor and earth. The concentric cables were laid on bridge pieces in glazed stoneware troughing, which was filled in with bitumen and covered over with stoneware bricks.

There are being installed underground, 33 cast-iron transformer tanks. The high and low-tension switches are mounted in cast-iron pillars placed above ground adjoining the pits. The pillars were furnished complete by Messrs. Ferranti, Ltd. Distribution will be on the three-wire system with 240 volts across the outers.

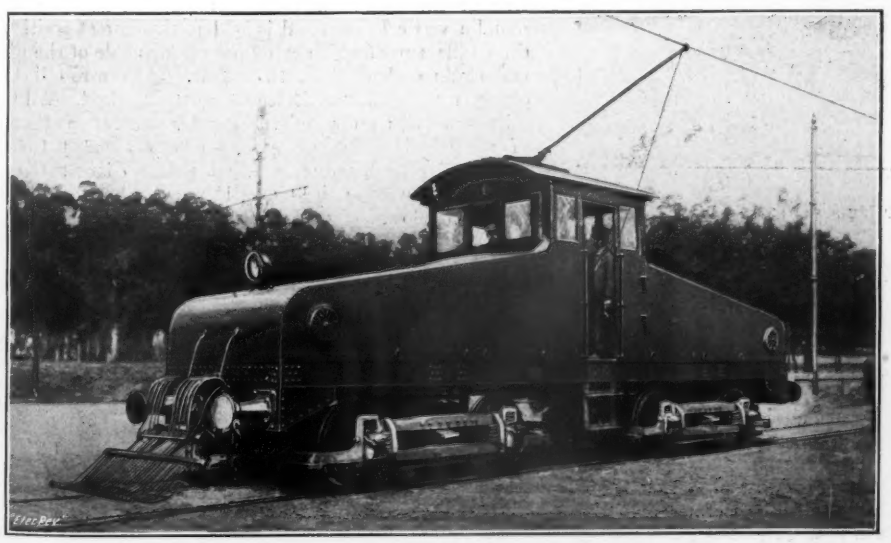


Para Tramways : New Car with Old Cars Used as Trailers.

ELECTRICAL LOCOMOTIVES FOR THE LA CROZE TRAMWAYS.

For the rural tramways of La Croze, South America, Messrs. Dick, Kerr & Co. have recently supplied six electric locomotives of the central cab type, mounted upon Brill type bogie trucks for a track gauge of 4 ft. 8½ in.

Each locomotive is equipped with four traction motors, each capable of an output of 50 H.P. on the 1-hour rating basis, when operating on a 500-volt D.C. circuit. The locomotives have a total tractive effort at full load of 5,720 lb. at the car wheels at a speed of 13·2 M.P.H., the current taken being 90 amperes per motor, or a total of 360 amperes. The diameter of the truck wheels is 34 in., and the gear ratio of the motors is 71/15.



Dick, Kerr Locomotive, La Croze Rural Tramways.

The motors are operated through a controller having five series and three parallel notches; there is no electrical brake, but each locomotive is fitted with a Christensen straight air brake equipment.

The current is collected from the overhead trolley wire by means of a single trolley of the straight under-running

single-deck type. The maximum speed is a little over 20 miles per hour.

The locomotive measures 30 ft. long over the head stocks, and 7 ft. wide over the side sills. The bodies were built at Messrs. Dick, Kerr's general engineering works at Kilmarnock, the equipments being made at the firm's Preston works.

The principal contractors for the rural tramways were Messrs. J. G. White & Co., to whom Messrs. Dick, Kerr and Co. were sub-contractors for the locomotives described here.

ELECTRICITY FROM WIND-POWER.

The utilisation of the wind as a source of power was probably the very first method by which man converted to his own use the stores of energy available in Nature; he spread abroad his primitive sail, and his rude bark was wafted across the creek which separated him from his innocent and unsuspecting neighbour, whose premature decease no doubt celebrated the first great step in engineering.

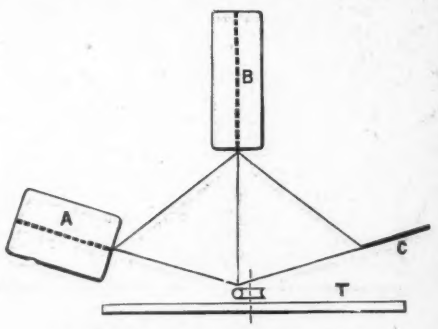
Wind-Turbine at Messrs. Childs's Works.

The development of the four-armed windmill from this initial effort must have occupied countless ages, and even now the evolution of the aer-motor is in a comparatively backward state; the apparatus employed, though greatly improved within the last 20 years, is at its best but a crude and imperfect machine. It is comparable, perhaps, with the undershot water-wheel. We are informed that it is impracticable to apply the true turbine principle to the so-called wind turbine—there are no stationary guide vanes, and much of the power available may be lost for want of these.

In spite, however, of the imperfections of the apparatus, and the fickle nature of the agent, repeated attempts have been made to utilise wind power for the generation of electricity; we have given full particulars of some of these, especially the Danish experiments, during the last few years. In this country, where the wind is extremely variable both in force and in duration, the subject has received less attention than it deserves; it was with pleasure, therefore, that we accepted an invitation from Messrs. J. G. Childs & Co., Ltd., of Willesden Green, to visit their works and inspect the system which they have developed, and with which they have been lighting their works for some months past.

The driving plant consists of a wind turbine on a steel tower 50 ft. high, and embodies some novel features. As, of course, is well known, the plane of the turbine wheel should be at right angles to the wind when in the working position; to enable it to automatically adjust itself to the varying direction of the wind, the main frame of the machine swings round a vertical pivot, and is held in the correct position by three tails, two of which stand out on each side of the wheel, making an angle of about 15° with it. The centre tail stands out approximately at right angles with the wheel. All three tails are carried on a light triangular structure at the back of the wheel, which gives support at about 7 ft. from the pivot. The small tail is fixed, but the two larger tails are free to rotate from the vertical into the horizontal plane, as shown below. When these tails are in the vertical plane, the machine is in the running position, with its wheel at right angles to the wind, as the resultant pressure of the wind upon the wheel and the tails maintains this position; but when the two tails are turned into the horizontal

Design for Self-Contained Wind-Electric Plant.



A, B, pivoted tails; C, fixed tail; T, turbine.

Diagram of Controlling Device.

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position, it is evident that the fixed remaining tail is unbalanced, and the force of the wind slews the wheel round until the wind is blowing approximately parallel with the plane of the wheel, and thus has no effect upon it. To assist the tails in controlling the wheel, the centre of the wheel is about 9 in. away from the centre of the vertical pivot, thus producing a tendency on the part of the wheel always to turn out of the position at right angles to the wind.

The two movable tails are connected by a steel wire rope to a small weight at the bottom of the tower, and by pulling this weight and fastening it to a hook, the wheel is permanently thrown out of the wind. On releasing the rope the tails fall by their own weight into the working position. The movable tails are so balanced on their pivots, which are fixed much nearer the upper than the lower edges of the tails, that when the wind rises beyond a certain predetermined limit, the tails automatically move out of the vertical position, and in proportion to the velocity of the wind tend to take a horizontal position, thus allowing the wheel to turn more and more away from its working position. The effect of this is that in heavy winds the amount of power exerted by the wind on the turbine can be kept within the measure of that required for the generator, and this enables the plant to look after itself in the strongest gales; as is well known, the energy contained by the wind increases as the third power of its velocity, and in heavy winds the amount of power will be greatly in excess of that required by a generator designed to work under average conditions.

The generator is of 2 KW. capacity, working at 130 volts, and has a speed variation from 800 to 1,600 revolutions per minute. The armature shaft is placed vertically, and is driven by means of a belt from a pulley placed at the bottom of the vertical shaft of the wind-turbine tower. The control of the field circuit is effected by resistances worked by relay switches in series with the main circuit. In this particular plant, there are six steps. It is obvious that as the velocity of the wind increases, the power available on the turbine also increases, and it is possible to so adjust the relay switches that they switch resistance in or out of the field circuit, as the velocity of the wind increases or decreases. Thus instead of governing on the speed of the wheel, the governing is done on the output of the wheel, and in practice this works admirably, the object being, of course, to allow the wheel to run at its most economical speed within the range for which it is designed.

Besides the relay switches, there are the usual switching arrangements required for charging accumulators. A special automatic switch is provided for cutting the battery in and out in accordance with the voltage of the generator, which enables the plant to be left entirely to look after itself. So reliable are the arrangements, that charging can go on day and night and through the week ends without any attention whatever, and the winds whether light or strong are made use of.

The principal moving parts, including those of the motor, run on ball bearings. The worm gear runs in oil, enclosed in a cast-iron box. The effect of these arrangements for lubrication is most satisfactory, as the plant requires scarcely any attention in this respect, and the cost of lubrication is insignificant.

The plant running at the works is capable of producing about 1,500 units per year with the conditions of wind such as obtain in London at the height of 50 ft., but by building the tower higher, better results could be obtained.

The firm have closely investigated the ruling winds, and find that there is a surprising variation according to locality; for instance, on some parts of the coast the wind power available is from three to four times greater than it is in London, and, speaking generally, all round the coast there is a much better wind supply than in London. It does not follow, therefore, that a plant which gives certain results in one place will give the same in another.

This turbine, tower, generator, and switchboard could be supplied for about £150, to which should be added the cost of the indispensable storage battery, of size depending upon the requirements in any particular case. In places where failure of the wind for more than a few days is liable to occur, a small stand-by oil engine is a desirable adjunct.

The company have covered their novelties by several patents on the tails and the switchgear.

Although the variability of the wind—worst of all, the liability to frequent long spells of dead calm—militates against the use of wind turbines in certain localities, there are, on the other hand, many large areas where the air currents are both constant and strong, as, for instance, in South Africa; in such places far greater use might well be made of wind power. It is hardly necessary to point out that the introduction of the metallic-filament lamp has immensely improved the possibilities of the wind turbine, for a battery of the same size as formerly required is now able to provide the same amount of lighting for three times as long. Alternatively, the same light for the same time can be supplied with plant of one-third the size hitherto needed, the choice between these alternatives depending mainly upon the climatic conditions as regards the prevailing winds.

The plant at Messrs. Childs's works is always left in the running position, and generates current with all winds above about six miles per hour. At the time of our visit a demonstration of electric lighting, cooking and ironing was in progress, the whole of these operations, including the cooking of a dinner for eight persons, being performed with current from a Hart battery charged solely with energy derived from the wind. The object of this was to demonstrate the advantages to be derived from the installation of such a plant in a country house or other establishment where a public supply of electricity was not available. Another use to which the power can be applied is that of working electric lifts—a feature which Messrs. Childs & Co., whose works have for many years been largely devoted to the manufacture of electric lifts, naturally lay stress upon. Electric automobile batteries may be charged, farm machinery operated, water pumped, and so on, almost all the advantages due to a supply of electric power being thus realised at a moderate cost.

One of our illustrations shows the tower and turbine erected by Messrs. Childs at their works; another, their design for a self-contained plant, with dynamo room and battery room built into the bottom of the tower. The firm are prepared to supply wind turbines of all sizes up to 100 ft. in diameter, for 150 H.P.

Héroult Furnaces.—Some idea of the rapid growth of the electric steel furnace may be obtained from the following list, which includes those in both Europe and America. When it is remembered that this furnace, as in the case of all the others, is the outcome of the ingenuity of an electrician and chemist, and not a practical steel maker, it must be regarded as little short of wonderful. The following list is taken from *E.M.I.*, the number of furnaces being given in parenthesis:—

	Finished furnaces. Kg.	Under construction Kg.
Richard Lindenberg, Germany (3)	5,300	—
Bismarckhütte, Germany (2)	4,000	—
Deutsch-Oesterreichische Mannesmann-Röhren Werke, Burbeck (1)	—	3,000
Danner & Co., Austria (1)	2,000	—
Gebr. Böhler & Cie, Austria (1)	2,500	—
Georg Fischer, Switzerland (3)...	1,000	10,000
Soc. Electromet. Française, Savoy (1) ...	3,000	—
Acieries du Sant du Tarn, France (1)... ...	5,000	—
Aktiebolaget Héroults Elektriska, Stal, Sweden (1)	4,500	—
Halcomb & Co., N.Y., U.S.A. (1)	5,000	—
Firth Sterling Steel Co., U.S.A. (1)	3,000	—
Soc. Tubi Mannesmann (2)	—	12,000
Edgar Allen & Co., England (1)	—	3,000

In addition to these the following firms are erecting plants of unknown capacity:— Bismarckhütte, Deutsche Mannesmann-Röhren Werke; Kaernthner Eisen und Stahl Werke, Austria; Gebr. Böhler et Cie; and Edgar Allen. From this list the progress of Continental manufacturers is quite apparent. Only one English firm has advanced as far as the electricity of the times.

Annual Supper.—The annual supper and dance of the employés of the Paisley District Tramways Co. was held in Johnstone Town Hall on Thursday, March 11th. Mr. Coutts, the general manager, in the course of a few remarks, complimented the ambulance team on their success in gaining the "Peter Coats Challenge Cup."

NOTES.

(*Continued from page* 518).

Institution and Lecture Notes. — Liverpool and District Electrical Association.—On Tuesday, March 16th, a paper was read before the above Association on "Arc Lamps" by Mr. W. H. Fennell, of Birkenhead. Some discussion arose as to the respective merits of metallic-filament lamps and arc lamps for street lighting, and further discussion will take place at the next meeting on March 30th.

By the courtesy of Mr. T. D. Clothier, the borough electrical engineer, the members of this Association paid a visit on Saturday, March 20th, to the Bootle electricity works.

Nottingham Guild of Mechanical and Electrical Engineers.—There was a large attendance at the twelfth annual dinner held at the Welbeck Hotel, on Friday evening, when Mr. F. W. Davies, A.M.I.M.E., presided. Lord Henry Bentinck submitted the toast of "The Mayor, Magistrates and Corporation." Referring to the administration of education by the local authority, he said much in that direction might be done in co-operation with the captains of industry. Apprenticeship was dying out, industry was getting so specialised that it was almost impossible now to carry on skilled work by unskilled labour, and boys were kept so long at a particular specialised part of their work, that they got very little opportunity of learning their trade as a whole. That was an evil the education authority ought to tackle, and they had a right to ask that the captains of industry in the district should help them. Councillor Ball, chairman of the Corporation Gas Committee, in responding, referred to the enormous strides that had been made by Continental engineers and advised the guild to organise a trip to the Continent to some of the huge engineering concerns there. A few years ago Continental engineers were nowhere as compared with English engineers, but that position was being lost, and if the English did not wake up the foreigners would soon be in front. Twenty-five years ago, every bit of gas plant in use in Continental works was made in English workshops, and officials of the works were in almost every case Britons. To-day the plant in German works, in many cases in advance of English plant, was made abroad, and in addition thousands of pounds worth of machinery was being sent by them to this country. Subsequent speakers paid eloquent tribute to the late Alderman Bennett, who held the position of President of the Guild from its inception up to the time of his death, a fortnight ago. Mr. F. W. Davies was elected president in place of Alderman Bennett, upon the motion of Mr. F. A. W. Taylor, seconded by Mr. E. Goddard. Mr. Davis suitably responded.

Institution of Civil Engineers.—The annual dinner of the Institution took place on Friday last, Mr. J. C. Inglis, the president, being in the chair.

The Institution of Civil Engineers.—Students' Meeting.—At the meeting held at the Institution on Friday, March 19th, at 8 p.m., Mr. R. E. Commans, M.Inst.C.E., in the chair, Mr. C. J. Guttmann, B.Sc., Stud.Inst C.E., read a paper, entitled "Some Aspects of Chemical Engineering." The paper demonstrated clearly the varied experience necessary for those engaged in designing and laying down plant for the explosives, mining, sugar and chemical industries. The paper was illustrated by a number of lantern slides and several diagrams, and the author also exhibited some models, and specimens of ferro-silicon and fused silica ware. A good discussion followed the reading of the paper, in which Messrs. C. Chubb, G. Ingram, B. Gaudin and D. G. French, took part.

Royal College of Surgeons.—Prof. Cecil Rowntree, of the Middlesex Hospital Cancer Research Laboratories, delivered a lecture on Wednesday last week before the Royal College of Surgeons on "X-Ray Cancer." Evidence was brought forward to show that X-rays had two separate and distinct actions upon animal and vegetable cells. In relatively large doses they had a destructive or paralysing action upon cell activity, whereas in small and oft-repeated doses they brought out exactly the opposite condition, and stimulated the tissues to abnormal activity and increased growth. Prof. Rowntree was of opinion that these observations might have an important practical application in connection with the treatment of cancer.

Institution of Electrical Engineers (Glasgow).—A paper entitled "Notes on the Safety of Working Electrical Plants in Coal Mines," was read before the Glasgow Local Section of the I.E.E. on Friday last.

Mr. J. H. McMinn recently read a paper on "Electrically-Driven Centrifugals and Accessories," to the Glasgow Students' Section of the I.E.E.

Institution of Electrical Engineers (Newcastle).—There was a demonstration on Saturday, at the invitation of Mr. F. Tremain, superintending engineer, Northern District, of Post Office Telegraphs, of long-distance telephone transmission and of special means of telephoning through cables, to test the relative efficiency of aerial and underground lines for telephone purposes. Mr. Tremain explained the cable system, so far as it had been completed, and the visitors spoke through from Newcastle to London, London to Glasgow, and thence to Newcastle, a circuit of about 700 miles. To London and Glasgow the conversations were clear, but the distinctness decreased as the circuit was extended. The new underground cable to North Shields was tested, with satisfactory results. Conversation with Belfast, *via* Leeds and Stranraer, was conducted with clearness.

On the 6th inst. the seventh annual dinner of the Students' Association of the South-West London Polytechnic was held at Frascati's, Oxford Street, the principal, Mr. Sydney Skinner, M.A., in the chair. After the loyal toasts had been honoured, the chairman proposed the health of their guest, Mr. W. Hayes Fisher, chairman of the Governing Body of the Polytechnic, and of the L.C.C. Finance Committee. Mr. Hayes Fisher, in reply, said the Finance Chairman would promise that the Polytechnic Chairman should have a most sympathetic hearing in connection with the proposed extension of the Polytechnic buildings, and that he was trying to get the Council to spend money out of capital in this direction, instead of out of revenue.

Dinner.—The staff dinner of the South Metropolitan Electric Light and Power Co., Ltd., was held on 17th inst., at Greenwich, with Mr. Henry W. Bowden, managing director and engineer-in-chief, in the chair. A musical programme by members of the staff followed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. H. Emery, for some years manager of the Northern Counties station at Thirsk, has resigned, and Mr. J. A. Carr, of the Morpeth works of the same company, has taken his place.

Mr. A. L. Gardiner, engineer-in-charge on the Burton-on-Trent and Ashby Light Railway Co., who is leaving to join the staff of the Isle of Thanet Light Railway Co., has been presented by the staff with a travelling bag.

General.—Mr. Arthur P. Strohmenger, analytical chemist, notifies that his laboratory and address has been removed to Caxton House, Westminster, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Marconi's Wireless Telegraph Co., Ltd. (53,403).—Mortgage dated September 30th, 1908, supplemental to deed of even date, securing £1,465 16s. and 5 per cent. interest, charged on part of Angrouse Estates, Mullion, Cornwall. Holder: P. H. Williams and Mrs. E. M. Williams.

Durham Collieries Electric Power Co., Ltd. (83,421).—Particulars of £200,000 debentures created by resolutions of February 19th and December 21st, 1906, and secured by trust deeds dated March 18th, 1907, and February 12th, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £50,000. Property charged: Certain leasehold premises, shares, debentures, and instrument of charge, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Trustees, Executors and Securities Insurance Corporation, Limited.

Oriental Telephone and Electric Co., Ltd. (40,691).—A memorandum of satisfaction to the extent of £1,600, on February 17th, of debenture stock, covered by trust deed dated June 2nd, 1905, and supplemental deed dated June 12th, 1907, securing £200,000 (of which £150,000 has been issued), has been filed.

CITY NOTES.

South London Electric Supply Corporation, Ltd.

The meeting was held on Tuesday at the Cannon Street Hotel, Mr. J. Atherton presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, March 19th, p. 484), congratulated the shareholders upon the continued steady progress in the business. The number of lamps added to the circuits last year was equivalent to 25,696 8 c.p., which had fully borne out the anticipations he expressed at the last meeting, that they would during 1908 add the largest number of lamps ever connected by the company in any one year. The total lamp connections at the end of the year amounted to 187,926, since increased to over 191,000, and the total units sold to 3,182,820, as compared with 2,661,454 in 1907, an increase of 521,366, or just under 20 per cent., producing an increased revenue of £3,022. Notwithstanding the increased output, their total cost for production was less than in the previous year by £375, which he thought reflected great credit on the management. The profit on the year's working had thus been increased by £3,398. The average price realised for the year was 2·54d. per unit as compared with 2·84d. in 1907, a decrease of over 9 per cent. due in a large measure to the greater number of units sold for power purposes, and to some extent to a reduction in the sales of lighting units caused by the more extensive use of the metallic-filament lamp. The temporary loss in revenue by the use of those lamps would, he felt sure, be quickly overcome by the demand being stimulated when it became better known that satisfactory electric lighting could be obtained so cheaply. The total cost per unit sold last year was 1·34d. against 1·54d. in 1907, a

decrease of 18 per cent. That satisfactory result had not been brought about by the installation of more economical plant, but was due to economies effected by gradual rebuilding and improvements made in the original boilers and plant, which work had now been in progress during the past four years. The cost of that had been mainly charged against the depreciation fund, and had thus largely increased the capital value of their plant. At the last board meeting their engineer said that the plant was to-day in a much better condition than it was 10 years ago. Their supply for power purposes continued to increase, and further contracts for that purpose with several large manufacturers were pending, which he had every reason to think would be completed in the course of a few weeks. The capital expenditure last year had amounted to £9,028, which included several important extensions to their mains some four miles in length. It was evident that they would want more plant to meet the increased demands, and they were about to place an order for a 1,500-kw. steam turbine and boiler, which would not only tend to an increased output but also to more economical generation. Having referred to the satisfactory issue of £100,000 5 per cent. first mortgage debenture stock, the chairman said that the London Electric Supply Act received the Royal Assent at the end of last year, under which the existing companies had power to make arrangements for mutual assistance and for other purposes. The Bills of the promoters who sought to introduce competition were rejected, and he hoped that the existing supply companies would not again be troubled with further promotions of the kind. A clause had been inserted in the London Electric Supply Act, conserving the right of the Lambeth Borough Council to purchase their undertaking in accordance with the agreement made between the company and the old Lambeth Vestry on March 16th, 1897. Should, however, the Borough Council not exercise those rights at or before the expiration of the year 1928, then the L.C.C. were empowered to purchase the undertaking in common with and upon the like terms and conditions of the other London companies. The gross profit for the year had amounted to £19,197, and from £14,770 carried to the general balance-sheet the board recommended a dividend of 5 per cent. per annum on the ordinary shares, carrying forward a balance of £1,770.

Mr. Littlehale, a shareholder, seconded the motion, which, after a short discussion, was adopted.

British Insulated and Helsby Cables, Ltd.

The annual meeting was held at Liverpool on Monday, Mr. E. K. Muspratt presiding. The Chairman moved the adoption of the report (see Electrical Review, March 19th, page 485). The profits for 1908, he said, were £193,831, as compared with £135,619 for 1907, an increase of £59,212. On the profit and loss account there was available for all purposes £222,167. Patents and goodwill had been written down, and now stood at the comparatively low figure of £71,500, as against £246,672 in 1906. Dealing with the operations of the company, the chairman referred to the Midland Electrical Corporation for Power Distribution and the Electrical Supply Co. of Victoria, in which this company was largely interested, and said that the former had not done so well as expected, while the latter had made sufficient profit to pay debenture interest and preference dividend. Not only was the British Insulated actively engaged in manufacturing every possible line in electrical cables and insulated wires, as well as large quantities of copper wire for its own consumption and general sales, but it had also taken up the making of many articles allied to, but not coming directly within the scope of, a cable business. At the Prescot works a large addition had been made in the sales of tramway fittings and appliances, for which an additional brass foundry had been erected. A mill for rolling aluminium sheets was also in full working order, and the volume of business coming to hand had already justified an extension of this plant. At Helsby the satisfactory progress of the "Helsby" tire had necessitated an increase in the manufacturing capacity, and the plant for making rubber wires and cables had also been extended, and many other small extensions had been made, with good results. This year considerable extensions were contemplated at Liverpool, Helsby and Prescot.

Mr. J. S. Harmood Banner, M.P., seconded the motion, which was passed unanimously, and the recommended dividend was declared.

Mr E. K. Muspratt was re-elected a director, and the meeting confirmed the appointment to the board of the Hon. Arthur Stanley, in the place of Mr. de Ferranti, resigned.

Mersey Railway Co.

The report for the half-year ended December 31st, 1908, says that the train-mileage run was 403,639 miles, as compared with 416,169 during the corresponding six months of 1907. The passengers numbered 5,720,877, as against 5,604,295, exclusive of season ticket holders. The total receipts from all sources were £52,193, as compared with £51,027. The working expenses, exclusive of the charges for pumping, ventilation and lifts, were £33,593, equal to 64·36 per cent., as against £33,205, equal to 65·07 per cent. for the corresponding six months. These charges for pumping, ventilation and hydraulic lifts for the past half-year amounted to £4,106, equal to 7·87 per cent., as compared with £4,103, or at the rate of 8·04 per cent. for the corresponding period of 1907. The directors have resolved to concentrate their offices at Birkenhead, and the head office of the company for the future will be at Central Station, Birkenhead.

Smithfield Markets Electric Supply Co., Ltd.

Mr. H. S. Leon presided on Friday at 57, Charterhouse Street, over the meeting of this company.

In moving the adoption of the report (see Electrical Review, March 19th, page 486), the Chairman said that the reduction of the capital by £1,146 might want some slight explanation, and it was due to the writing down of a certain part of their plant and mains which were no longer remunerative. In the past they had given them a good profit when they were used for supplying customers whom they had now unfortunately lost. The actual number of units sold was greater than in 1907—the increase being 104,000 units, or 5 per cent. of the total. This was due, however, to an increase of supply for power purposes, and not for lighting, and the consequence was that the average price fell in the current year from 2·17d. to 2·09d. per unit. The cost of production showed a considerable increase due chiefly to the high price of coal, and the higher charge for water. They had spent in the course of the year £1,000 more on coal. The price was 2s. higher, and the quality not so good. Then, again, their revenue had been materially affected by the introduction of the new metal-filament lamp, and as this became universally used in the market, they might have a further temporary loss. At least he hoped it would only be temporary, because it might fairly be anticipated that the introduction of these lamps would bring about a large increase in the consumption of current for they would be able to clearly prove that the electric light was cheaper than gas, and so obtain a good many more customers. Another misfortune was that during the past year trade had been bad in the market and dealers had been economising in every possible way. They, as a company, must do the same, and although it was a difficult task the board had determined to do their best in this direction, and trust that better results would ultimately be obtained in spite of the present unfavourable circumstances. It had been suggested that the directors should waive their fees, but he thought in the existing state of the company's affairs with all their worries they had every right to be paid for their services. However, no one on the board wished to receive more than he felt he had the right to receive, and that matter would receive consideration in the present year. They had now obtained an auxiliary supply of current, and therefore avoided any expenditure of money on plant. As their future was to some extent uncertain, it was not thought desirable to spend any money on capital account. It was hoped that they would save on generating costs under the new arrangement. The £1,988 profit for the year could not all be added to the capital account as there was the amount written off the capital account, and a small sum was spent on the auxiliary supply which reduced the amount. The reserve fund now stood at £20,386. With regard to works costs he would like to point out that whilst the output of other companies was much greater than theirs yet their cost was ·06d. per unit lower. It was impossible to anticipate the result of this year's working. There were many important developments about which he hoped he would not be cross-examined, and more than that he did not think he was justified in saying.

South Wales Electrical Power Distribution Co., Ltd.—The report for the 12 months ended December 31st, 1908, to be submitted to the meeting at Cardiff on 6th prox., states (according the *Financial Times*) that, after very protracted negotiations, the endeavour to form a Consumers' Company to work the Cwmbran area on the lines of the Treforest Electrical Consumers' Co., Ltd., failed. Arrangements have, however, been completed whereby the Treforest Co. will take over and supply the Cwmbran area from the Treforest generating station, by means of a connecting cable between the two areas. A portion of the proceeds of the sale of the Neath and Bridgend stations is being utilised for the construction of this cable, which will shortly be completed, thus enabling the Cwmbran station to be shut down or only used as a stand-by. This arrangement has the advantage of not only increasing the load on the Treforest generating station, but will also save the costs of working of the Cwmbran station. The agreement between this company and the Treforest Co. embodying the foregoing arrangement has received the sanction of the Board of Trade and of Mr. Stanley Boulter, the debenture agent, on behalf of the debenture stockholders of the company. The balance of the purchase money of the Neath and Bridgend stations will be dealt with in accordance with the principal agreement entered into between this company, the debenture agent, and the Treforest Co. The directors regret that Mr. W. Cope has found it necessary to resign his seat. Mr. John Andrews, a director of the Albion Steam Coal Co., has been elected to fill the vacancy.

Prospectuses.—*The Lyme Regis Electric Light and Power Co., Ltd.*—This company is advertising in the local press an issue of 3,500 ordinary shares of £1 each. The list is to close on Saturday, 27th inst.

Johore Rubber Lands (Malay States), Ltd.—This company has this week been offering 200,000 shares of £1 each for subscription.

Tebrau Rubber Estates (1909), *Ltd.*—An issue of 100,000 shares of £1 each has just been made. £64,000 was offered for public subscription, the remainder being issued as fully paid as part payment of the purchase price.

Italy.—Although the capital of the A.E.G. Thomson-Houston, Societe Italiana d'Electricita, of Milan, has been increased from £240,000 to £360,000 during the last financial year, a dividend at the rate of 8 per cent. is being maintained.

Folkestone Electricity Supply Co., Ltd.

The directors' report for 1908 says that the company continues to make satisfactory progress. The number of 8-c.p. lamps supplied has been increased from 96,300 to 103,999. Including the receipts from hired installations, the profit on the revenue accounts for the three undertakings amounts to £12,900. This amount, with the sum of £333 brought forward, and after allowing for interest on debenture stock, dividend on preference shares and bank charges, &c., and also for the interim dividend at the rate of 4 per cent. per annum paid on the ordinary shares, shows a balance of £6,528. Out of this £3,000 has been carried to depreciation fund, making it £11,000, and £450 to the reserve fund, making it £2,800, and a dividend at the rate of 7 per cent. (less income-tax) for the half-year (making 5½ per cent. for the year), which will require £1,750, is recommended, leaving a balance of £328 to carry forward. The directors have been successful in the past year in prosecuting an appeal against the Board of Inland Revenue in respect of the income-tax assessment made on the company, and have obtained an abatement of £233 which has been credited to the net revenue account. It is proposed shortly to make a further issue of 4½ per cent. debenture stock, to rank with the £90,000 first debenture stock already issued. The stock will be offered, in the first place, to the shareholders and stockholders of the company. Full particulars will be given in due course. The following is a statement of electricity generated, sold, &c.:—

Units generated	1,662,286
Quantity sold—Public lamps	88,293
By contract	375,530
Private consumers, by meter	868,061
Total sold	1,331,884
Used on works	29,200
Total accounted for	1,361,084
Not accounted for	301,202
Number of public lamps	88 arcs, 488 Nernsts and inc.
Total maximum supply demanded, kw.	1,091

Hastings and District Electric Tramways Co., Ltd.

The meeting of this company was held on the 18th inst., at 1, Queen Victoria Street, E.C.

Mr. E. C. Morgan, in moving the adoption of the report (see Electrical Review, March 12th, page 439), said that the year had been an exceedingly disappointing one. There had been an increase in expenses and a reduction in receipts. Coal had cost £315 more, but against this there had been a saving of £317 in the cost of water. There had been a small saving of £303 in the traffic expenses. Maintenance and repairs showed the large increase of £2,612. The principal item of decrease was in the maintenance and upkeep of the Dolter system on their front line, the cost of which up to the end of 1907 had been borne by the contractor. By the terms of the concession they were precluded from making their system homogeneous by constructing the front line with overhead wires, and they were, therefore, forced to make use of the Dolter system, which was, more or less, in the experimental stage. They had, however, by the strictest care, been able to keep the line running, but the cost of doing so had proved far in excess of what they had been led to expect, and it was this which had so greatly swollen their maintenance and repairs. During a period of nearly twelve months they had had to remove no less than 1,068 "dead" studs. They had been able to introduce some changes which tended to reduce their outgoings in this respect, but he feared that this portion of the line would always prove unduly expensive. The general expenses were practically the same as in 1907. The total working expenses were £35,497, an increase of £2,770 on the preceding year. This worked out at 6·15d. per car-mile, a very satisfactory figure when compared with the costs incurred in other places where the geographical conditions were similar to those in Hastings. The receipts had diminished by £1,585, which was very disappointing; but as decreases in traffic receipts of tramways had been almost universal during 1908, they could not attribute this to any fault in the conduct of the business, and it would be noticed that the receipts were higher per car-mile than they were in 1907. £34,856 had been spent on capital during the year. This consisted of expenditure for front line construction and for clearing up the various additions which it was found necessary to make to the contract to ensure the best conditions for working, and also the cost of sinking a well for supplying them with water. They had now to consider the manner in which the position could be improved. Apart from the difficulties of working such a line as Hastings, where the geographical conditions were so adverse and could not be altered, there were certain items of expenditure in which the directors believed that considerable economies were possible. The first was coal, of which the price in Hastings was very high, and they had been heavily handicapped in this direction by the stringent prohibition as regards smoke. To obviate this they had been compelled to make use of the most expensive quality of Welsh coal, which was absolutely smokeless. They had now made arrangements, under exhaustive guarantees, for the supply, by Messrs. Babcock & Wilcox, of four chain grate stokers, which, it was claimed, would enable them to use a much cheaper class of coal whilst maintaining absolute smokelessness. If these machines did what was claimed for them, they would effect a large saving in their bill for fuel. Not only had they taken steps with a view to decreasing their working expenses, but they were also endeavouring to increase their receipts, and for this purpose they were negotiating with the Corporation for an alteration in their fares. When they took over the concession it was hampered with an agreement between the Corporation and the original promoter of the company, which in many points varied from the conditions of the Act. One of the most important was the fixing of fares upon the principal main lines in Hastings and Ore, upon which they relied throughout the year for a steady business traffic. It was obvious to them that these fares were too low, but they were compelled to give them a fair trial, and they had now informed the municipality that an alteration was essential. Negotiations were in progress, and they had reasonable hope that a satisfactory arrangement would be arrived at. As the result of what they had done and were doing, he felt confident that during the present year they would materially reduce the proportion of expenses to receipts, and secure a fair amount of net revenue for the service of shareholders' capital and for more adequate provision for the depreciation fund.

Mr. George Kitchin seconded the motion.

Mr C. W. Lydd said he must confess that the report was most disappointing. He had put a large sum of money into the company, but all he had got was 2 per cent. on his preference shares—which they could not really afford to pay—while they got nothing on the ordinary shares; and the capital was quickly perishing. The company was not a philanthropic undertaking, and shareholders should be considered as well as the public. Their cars were often packed and were always fairly full, and it was obvious that the fares were altogether too low.

Mr. Taylor said he agreed with the previous speaker that the preference dividend had not been earned. The board had spent a very large sum of money in repairs and renewals on a comparatively new tramway, which he thought required some explanation. In the prospectus they were told that the total capital expenditure would never exceed £328,000, but yet by the end of 1907 that amount had been increased by about £25,000 without a word being said to the shareholders. By the end of 1908 the capital expenditure had run up to £386,000. The management was hopelessly wrong, and he suggested that the board should add one or two to their number, perhaps a local man.

Mr. Collis said that the company was only suffering like many other tramway concerns, and he did not think it was fair to throw the blame on the board. The directors had the Dolter system thrust upon them against their will. In one case he (the speaker) knew where the system had had to be torn up and the overhead system substituted, and there was no doubt it was most extravagant.

The Chairman said the question of capital was a very difficult one, but as far as they could see, they would be able to carry on the company and improve the prospects of the shareholders without asking for more money. He was looking forward with great hopes to the raising of the fares. By the old conditions they were compelled to carry passengers 4 miles for a penny, which, of course, was not remunerative. He felt sure the Corporation would see the reasonableness of not compelling them to go on carrying people at a loss.

The report was then adopted.

Hove Electric Lighting Co., Ltd.

The annual general meeting of this company was held on the 17th inst., at Salisbury House, Mr. Carleton F. Tufnell in the chair.

The Chairman, after referring with regret to the death of Colonel Filgate, the late chairman of the company, said that the expenditure on capital during the year had amounted to £3,014, the principal item being for extensions of mains—in itself, he thought, a satisfactory feature. Chargeable to this account was an item of £756, which included the costs of the recent Board of Trade inquiry. This inquiry was forced upon them, and, as mentioned in the report, they had come out of it with flying colours. The Board of Trade unfortunately appeared to have had no power to grant them their costs, and it was rather hard upon the company that they should have to meet this expenditure, in view of the verdict given. The decision, however, had cleared away many questions and differences between themselves and the Corporation of Hove, and they were now looking forward to a period of more friendly relations. There had been an increase in the revenue from £22,035 to £23,402 in the sale of current, and the total revenue amounted to £24,694, as against £23,321 for 1907, an increase of £1,373. On the expenditure side of the account, the only item calling for comment was the cost of coal, stores, &c., which amounted to £4,435, as against £4,056, accounted for, of course, for the most part by the rise in the price of coal. This item appeared likely to show an improvement this year. In regard to the item, "Investments on account of sinking fund—at cost £28,573," this amount was actually invested outside their own business, and included interest accrued during the past year which, on the advice of their auditors, had been capitalised instead of being taken into the revenue account, their contention, he believed, being that it was not earned in the business of the company, viz., that of supplying electric current. The directors had thought it advisable to start a sinking fund, and in order that this fund should tally exactly with the £28,573 invested, they had transferred to the account the premiums received on shares and debentures, viz., £18,227, and taken out of the renewals and depreciation account an amount (£10,346) which was exactly sufficient to make up the former figure. With this deduction the renewals and depreciation account still remained at the respectable total of £19,604, increased by £1,500 from last year's accounts to £21,104. The increase in the units sold was 115,525. A great part of this was, however, due to the power supply given to the Brighton Omnibus Co., who, unfortunately, were shortly leaving them. In their supreme wisdom the Brighton Corporation

threatened not to renew their licence to the omnibus company unless they took their current from them instead of from the company—a fair sample of municipal trading. As the current was supplied by them to the omnibus company at a somewhat cut rate, the loss to the revenue would not be serious, and would, he trusted, be more than made up for by an anticipated saving in coal this year. On December 31st, 1908, there were still as many as 38 consumers on the 110-volt pressure, as against 1,638 on the 220-volt pressure, whilst there were 227 houses, representing about 7,500 33-watt lamps, disconnected from the mains. A large number of their consumers had entirely adopted metallic-filament lamps, and in many cases the decrease in consumption had been from 40 to 50 per cent., but, combined with this saving in cost, there was a very general tendency for consumers to use a higher candle-power. This craving for additional brilliancy was apparent wherever they turned, and more especially in shops. Much as the gas mantles gave a fillip to the gas companies, so, in his opinion, would the new metallic-filament lamps work wonders in the extension of electric light as a luminant, and assist electricity in the competition with gas. One of the shareholders had written him regarding the terms on which the Hove Corporation could take over the property. The lease was for 42 years from 1892, and at the expiry of that time their powers lapsed and the local authorities could purchase their plant and mains, or not, as they saw fit. If they did they must pay for them; if they did not, they had two alternatives, either to deprive the householders of current for lighting and power purposes altogether, or to erect their own plant and lay their own mains. In the meanwhile, the authorities had the option in 1913, and at each subsequent period of seven years, to buy them out under the following clause:—

> At the expiration of twenty-one years from the date of these presents and at the expiration of every seven years thereafter the Commissioners shall be at liberty, if they think fit, on giving twelve calendar months previous notice to the company, to purchase the undertaking, buildings, works, machinery and plant of the company either by (1) paying to the company the amount of the legitimate capital expenditure of the company, with such sum added as shall, with the profits previously made and available for distribution as dividend, make up a total cumulative dividend of 7 per cent. per annum on the capital actually received by the company from the shareholders, or (2) on paying for the undertaking by valuation as a going concern and not subject to the restrictions set forth in the second Section of the Electric Lighting Act, 1888. The amount of such legitimate capital expenditure or of such valuation, as the case may be, to be settled, in case of dispute, by arbitration.

As regarded the future, it was not for him to prophesy. The recent visits of His Majesty the King to Hove could not fail to have had a beneficial effect upon the place, and the general depression which had recently overshadowed Brighton and Hove, as other places, appeared to be lifting. Several of the empty houses were filling, and there were clear signs of an improvement in house property. The price of coal, too, might be reduced, which would assist them. On the other hand, they were threatened with a Daylight Saving Bill, which, according to published estimates, was to effect a saving to the railway companies in Great Britain of £95,000 a year for artificial lighting. He did not think they need fear its depredations for the current year; but if the promoters' wishes were eventually realised, there was little doubt that they would suffer, to a certain extent, along with other supply companies. Their company was essentially a lighting and not a power company, but when they considered that the summer six months only provided about one-fifth of their year's revenue from lighting, and that at a most liberal estimate they could not suffer more than one-fifth of this revenue from changing the clock, they might anticipate that but a small portion of their annual lighting revenue could be lost to them.

Col. Henry Wood, C.B., seconded the motion, and the report was agreed to unanimously.

City of London Electric Lighting Co., Ltd.

The meeting of this company was held on Wednesday, March 17th, at Salisbury House, Mr. J. B. Braithwaite in the chair.

The Chairman, in proposing the adoption of the report (see Electrical Review, March 12th, page 442), said the capital expenditure, which included all new works in 1908, had amounted to £44,709, which compared with £87,068 in 1907, or about one-half. On previous occasions he had told them that their capital expenditure would tend to decrease. During the current year it would be somewhat larger than it was in 1908, as they had got a large new unit of plant, and certain other additions to their works which they were making. They had been able to meet this capital expenditure without any further issue of capital. It was some years since they had had to make an issue of fresh capital, and at the present moment there was no indication that it would be necessary to do so. The gross revenue showed an increase of £2,379, but owing to increased expenses the net revenue showed a decrease of £5,362. The main item in the increased expenditure was coal, for which they had had to pay more than previously. The economy in the use of coal was still continuing; although they sold nearly a million more units, the total coal used was about 600 tons less than in 1907. They had placed their coal contracts on considerably improved terms, which would carry them through to the summer of next year. Rates had increased by nearly 2¾d. in the pound in the City, and by 4d. in Southwark. In the latter place they had an electric lighting undertaking of their own, and they as ratepayers had to contribute to the upkeep of that undertaking, which last year had cost them £950 extra. The total increase in expenses was £7,741. The amount available for dividends and reserve was £90,443, as against £83,513, an increase of £6,930. It might appear strange that although they had a decrease in their net revenue of £5,000 odd, they had nearly £7,000 more available for dividend. That was due to the following items which appeared in last year's accounts not recurring—Parliamentary expenses, £1,093; experimental street lighting, £1,114, and a reserve of £1 600 for doubtful debts which had not been required; and they also made a special provision of £8,400 to the capital account. He regarded their normal carry forward as £20,000, but on this occasion they had raised it by nearly £7,000 to provide against any possible contingencies which might occur during the current year, and they would feel themselves fully at liberty, should circumstances require it, to withdraw that £7,000 and reduce the carry forward to its normal £20,000. On December 31st they had the equivalent of 1,182,266 30-watt lamps connected, being an addition of 59,566 lamps during the year. Their reserve funds continued to creep up; they now stood at a total of £324,387. They again placed £45,000 to depreciation reserve, and £500 to leasehold redemption, and they had again met out of that fund the cost of the absolute demolition of old and obsolete plant. That figure for the past year was £32,461, as against £38,958, so that as they went along they were writing off the whole of the obsolete plant, which had been replaced by new and up-to-date machinery. The great event of the past year had been what had taken place in the Parliamentary Committee-rooms. For several years past they had been engaged year after year in opposing large and speculative power schemes, which, had these become law, would have been very serious factors in the electric lighting situation in London. The London and District Electricity Supply Bill passed the House of Lords Committee, but when it got before the Commons they were able to convince the Committee that the figures put forward on which the scheme was based were entirely erroneous, and they threw out the Bill. He was inclined to think, in view of the figures put forward, that it was very unlikely that an application on these lines would be renewed. On the other hand, the Bill that they promoted in conjunction with seven other of the London companies had become law. They received very great assistance from the President of the Board of Trade in the matter, who worked extremely hard to bring about harmony in conflicting interests. That Bill gave them what they had sought to get for many years past. Shortly, it gave them power to enter into agreements with other companies, or with local authorities who were supplying electricity, for their mutual benefit and assistance, and it gave them the opportunity, should occasion arise, of supplying electricity in bulk or taking it in bulk from either of the companies or a local authority. That must tend greatly to the unification of the London electric supply and to increased efficiency in production, with consequent benefit to the general public. In addition to that, the L.C.C. was substituted as the ultimate purchasing authority instead of the various local authorities. Referring, in conclusion, to the metallic-filament lamp, he said that the lamp had been considerably developed during the past year, and it was now in pretty general use. It undoubtedly effected a considerable saving in the amount of electricity consumed to give a given amount of light. Their point of view was that they welcomed all inventions which enabled their consumers to use their supply to better advantage, for they felt that, whatever the momentary effect of such inventions might be, their ultimate effect must be to still further popularise the use of electricity, and that must be in their interests. Therefore, so far from regarding that lamp as a drawback or something to be regretted, they regarded it as a distinct advantage, in that it would strengthen their hands decidedly in the continuous competition in which they were engaged with gas and other forms of illuminants.

Mr. F. W. Reynolds seconded the motion, and the report was adopted.

Direct Spanish Telegraph Co., Ltd.

The meeting of this company was held on the 17th inst. at Electra House, the Marquis of Tweeddale presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, March 12th, page 443), said that the traffic receipts showed a decrease of £1,104, which was accounted for by the general depression in trade, as well as by the fact that no exceptional events of international importance occurred during the year under review, as was the case in 1906 and 1907. They had reason, therefore, to congratulate themselves that the receipts had been well maintained. They had been spared any interruption of cables during 1908, but an interruption to the Bilbao cable occurred on January 19th of this year close to the landing place in Spain. The work was repaired locally by the company's superintendent, with assistance sent out from England, thus avoiding the expense of sending out a cable-ship. The interruption lasted 15 days, bad weather having interfered with the repairing operations. The debentures which were issued in 1905 to enable them to place the Barcelona cable in perfect condition had now been paid off. The reserve fund stood at £47,210, or £1,150 less than in the previous year. It must, however, be borne in mind that £8,104 had been applied towards the reduction of the second mortgage debentures. Their securities still showed a depreciation of 14 per cent. He trusted, however, that before they disposed of any of them, that depreciation would have been considerably reduced. The International Telegraph Conference was held last year in Lisbon, at which their company was represented. If they were able to go on for a time free from interruptions they would appreciably increase the reserve fund. The necessity of a large reserve fund had been recognised by all cable companies, and he would point out that the amount of their reserve at present was not nearly sufficient to pay for the renewal of the Bilbao cable, which was 25 years old. He was pleased to

be able to say that business between Great Britain and Spain showed every sign of increase, and the friendly relations between the two countries were fully maintained, so that with freedom from costly repairs he thought they might look forward with confidence to the future.

Sir John Denison Pender, K.C.M.G., seconded the motion, and the report was adopted.

London United Tramways, Ltd.

Mr. C. J. Cater Scott presided on Monday at Winchester House, E.C., over the meeting of this company.

In moving the adoption of the report (see Electrical Review, March 19th, page 485), the Chairman said it was with the greatest regret that the board came with a report and accounts which they admitted were unsatisfactory. If they took the revenue account they would find on the debit side that the traction expenses had increased from £32,078 to £36,570. Their mileage for the year was practically the same as in 1907, and the whole of the increase of £4,432 was due to the extra cost of coal and stores. During the present year they were finding the benefit of cheaper coal contracts, and times were also more favourable for buying stores, so that they hoped during the current year the whole or the greater part of that increase would disappear. The traffic expenses were £109,689, against £111,479, a saving of £1,790, made up of small savings on miscellaneous expenses. The general expenses were £22,539, against £22,439. The charges for maintenance and repairs were £51,492, against £48,676, and this increase was not on the whole unsatisfactory, because it showed that even during bad times with every inducement to cut down expenses they were not starving the tramroad, but were doing their best to maintain it in proper working order. On the credit side the traffic receipts and sundry revenue showed an increase of only £2,820; and this, despite the fact that during last year the whole of the system was at work, whereas during the previous year a considerable portion of the Surrey lines were only at work for a number of months. Their trouble was undoubtedly due to the want of expansion of receipts and of development in their traffic, which had certainly not been what they anticipated for the new lines. For this want of expansion there were three causes: The first was unfavourable weather. In 1908 there were no fewer than 30 wet week-ends, against 24 in 1907, and when they had a bad week-end it meant a difference of £800 to £1,000 in their receipts. The Easter period was bad, and their receipts were only £6,649, as compared with £8 568 in 1907. The second cause was the Franco-British Exhibition. They had expected good results from the Exhibition, but the receipts from visitors going there were very disappointing, whilst the Exhibition also took away many who would have travelled on their tramways to the Thames Valley districts. As to those two causes they could do nothing. The third and chief cause was the competition of the motor-'buses, and in this connection he felt that they were entitled to some relief. The chairman proceeded to describe the various stages through which tramway promoters had to go to obtain Parliamentary sanction to construct tramways, and said that when they got before a Parliamentary Committee, they were confronted with a long row of counsel representing local authorities who all wanted something. Some wanted wayleaves, and some what they called protective clauses, which were of little or no benefit to the public, but which hampered construction and increased the cost. The company had had to carry out very expensive widenings, and of its capital of £4,000,000, 25 per cent. had been spent on such street widenings, Further, they were required to pave the road between the rails and for a certain distance each side and to maintain it afterwards, and his experience was that in this paving and maintenance they were called upon to do work in a much more excellent manner than the local authorities would do it if they had to carry the burden. They had also restrictions imposed on them as to speed and stoppages. After doing all this, no sooner had they made a paying traffic than the motor-'bus came in, and paid no wayleaves, street widenings, paving or maintenance, but ran over the tramway track, which afforded them the best road, and added greatly to the cost of wear and tear. The 'buses had no compulsory stoppages, and they nursed the tramcars and took away the traffic. Then there was the question of rates. The motor-'bus companies paid rates on the garage, but the tramway company paid on their total income, and did not even receive the three-quarter reduction which railway companies received under similar circumstances. He thought they would agree that this was unfair to the tramways, which were of enormous benefit to the public. Personally, he felt it was their duty to protest most strongly against this unlimited competition after they had received Parliamentary sanction for their operations. Another thing was that under the Tramways Act the local authorities had the power to buy the concern after a certain number of years, but he did not see how, under the present conditions, it was possible for a tramway company to recoup itself for the expenditure incurred with the sanction of Parliament in the limited period now granted. It might be said that they took the responsibilities when they went to Parliament, and that was so, but the circumstances were absolutely different, and the introduction of the motor-'bus had completely altered the whole position. He said that to-day any man who attempted to build a tramway under the conditions imposed by the Acts, would be absolutely insane. If they put such conditions on them, tramway building, except by municipalities, was finished, and he doubted if municipalities would take up the construction of tramways in the way that the company had. The remedy which had been suggested was a very simple one, which, if taken up, could be carried through in a comparatively short space of time; it was to follow the advice of the Royal Commission on London Traffic, and establish a Traffic Board. If they had such a board, they would be able to regulate all the traffic of London, and would be able to secure such a system of working throughout the Metropolis as would not only secure tramway proprietors a reasonable return on the money invested, but would provide a permanently good service for the general public. They would not get a good service in anything unless it paid. On their routes which converged on Shepherd's Bush at the present moment, there were 129 motor-'buses running, which were not carrying enough passengers to pay them, but which diverted the traffic from the tramways, and which were to a great extent responsible for the unfortunate position in which the company found itself. They had a balance of £59,858, which in the ordinary way would have been sufficient to pay the full dividend on the 5 per cent. preference shares, but they felt they had to take seriously into consideration the state of the reserve fund, and they felt that even although they took something from the preference shareholders, they must put £15,000 to renewals, and the amount of their reserve funds would then stand at £39,160. The preference shareholders would get 3¾ per cent. for the year. It was unfortunate, but he thought the shareholders would agree that the board had taken a proper course. It would be asked what they proposed to do in the future, and he would be perfectly frank. Until they could put by, year by year, a sufficient sum to the renewals fund as was fairly reasonable, he was afraid the preference shareholders would have to be content with 2½ per cent. When they would be able to improve upon that depended upon how their earnings developed. It might be that after one or two years they might be able to increase the distribution on the preference shares, but for his own part, after the disappointment they had had in the want of elasticity in their receipts during the past two years, he thought it difficult to forecast when they would get back to the full preference dividend.

Sir Clifton Robinson seconded the motion.

Mr. Fitch remarked that the tramways at Ealing were most unsatisfactory and badly managed, and the conductors were a most insulting lot of men. The extension from Hanwell to Brentwood, he considered, was money thrown away, and the same with regard to the line from Southall to Uxbridge. He thought the motor-'buses would sooner or later close up, for they were running at their last gasp.

The Chairman said they hoped that the Hanwell line would develop later on. There was no doubt that they would have hesitated to build some lines had they known of the motor-'bus competition. The preference shares were cumulative, and the shareholders would not lose their dividends. He did not wish to say much about their Bill in Parliament, as it would soon be coming before a Committee. Their terminal lines were in the area of the London County Council and would soon become purchaseable, and as they considered such an acquisition would be prejudicial, they were asking Parliament to defer the date of purchase for a number of years. They had also completed their tramways up to the boundary line at Tooting, and the construction of a few yards would enable a physical junction to be made, and it would be a great advantage for people to be able to ride from Westminster Bridge to Hampton Court. For some reason which he did not understand, those few yards of line had not been constructed, and they were asking Parliament to see that they were constructed, and to grant mutual running powers over the two systems. Frankly, he was surprised that a body like the County Council, which was supposed to have the interests of the Metropolis at heart, should take up this attitude and fail to connect, and he was quite certain that had the trams in South London been in the hands of a company, and there had been a failure to make the connection, the County Council would have been the first to complain.

The motion was carried, and the retiring directors re-elected.

Gateshead and District Tramways Co., Ltd.

The annual meeting of this company was held on Thursday of last week at the Electrical Federation Offices, Kingsway, Mr. G. R. Greene, J.P., presiding.

The Chairman, in proposing the adoption of the report, said that the total revenue for the year, including £1,738 brought forward from last account, amounted to £55,891. After deducting all expenses chargeable to revenue, including repairs and maintenance, the directors had decided to make a special provision for permanent way renewals, and they had, accordingly, debited £2,791 to that account. They had then an available balance for distribution of £21,907, and they proposed to deal with that as follows:—£3,000 to depreciation account; £1,778 to the sinking fund for redemption of mortgages; £6,756 for the payment of dividend on the preference shares; £9,450 for the payment of a dividend at the rate of 7 per cent. on the ordinary shares, which would absorb £9,450; and they would carry forward £921. Having regard to the strikes and lock-outs experienced in the ship-building trade throughout the year on the North-East Coast, the directors considered that the result of the year's working was satisfactory. It was satisfactory to note that £7,570 had been placed to various reserves, as compared with £5,810 in 1907. The mortgage interest was less, but the repayment to the capital account was correspondingly greater. There was a slight decrease in the administration and general expenses, although rates and taxes were rather up. On the other hand, traffic receipts were slightly down. They had carried 12,126,530 passengers, as compared with 12,177,711 in 1907. The average receipts per passenger were 1·03d. An agreement had been entered

into with the Corporation of Gateshead, which provided that in consideration of the Corporation deferring their powers of purchase under the Tramways Act, 1870, from 1922 until 1930 the company would, *inter alia*, extend the present Bensham route to the gates of the new cemetery, about ½ mile, and double the Low Fell route from Shipcote to the terminus, about 1½ miles. A Bill had been promoted in the present session of Parliament to confirm the agreement and for other purposes. The company had entered into a contract for the purchase of 2,239 sq. yards of freehold land adjoining the depôt for extensions. A further extension of time to October 22nd, 1909, had been obtained for the completion of that portion of the Wrekenton Light Railway which lay beyond the colliery wagon-way, which ran across the road just below the present terminus. It was expected that some arrangement would be made to overcome the danger of the wagon ways before the end of the present year. The undertaking in all respects had been maintained, as in past years, in good order and repair.

Mr. S. H. Day seconded the motion, and the report was adopted.

Llandudno and District Electric Tramway Construction Co., Ltd.

The directors' report for the year to November 30th, 1908, states that the profit for the period, after providing for operating and administration expenses, and interest on loans, amounted to £5,299, which is to be applied as follows:—In placing to depreciation reserve account, £500; in writing off preliminary expenses account, £1,500; leaving to be carried forward, £3,299. The complete line from Llandudno to Colwyn Bay was not available for traffic until June 6th, 1908. The accounts therefore only represent the working of the whole undertaking for about six months. The curtailment of the holiday season owing to abnormally bad weather in August and September, also adversely affected the year's returns.

As the result of the experience gained last year, steps are being taken to increase the facilities for traffic on the line by additional rolling stock, and the directors confidently anticipate much better results for the current year. The gross receipts since the closing of the accounts show a high rate of increase over the corresponding period of last year. The extension to Old Colwyn is still under consideration by the authorities, and it is expected that a settlement can be arrived at and the order obtained in the near future. The directors are of opinion that this will prove to be a valuable addition to the company's system. It will be necessary to make arrangemets to pay off temporary loans and to provide funds for future capital requirements, including the completion of the Old Colwyn extension, and the directors therefore recommend that the borrowing powers of the directors should be increased to £75,000. It is also proposed to change the company's name to "Llandudno and Colwyn Bay Electric Railway, Ltd." Resolutions in respect of both these matters will accordingly be proposed at the meeting. Mr. Roland S. Portheim and Mr. Charles H. Rigg have retired from the board, and Mr. A. W. Tait was appointed a director on 3rd inst. in the place of Mr. Portheim.

Route-miles constructed	6·6
Car-miles run	185,092
Passengers carried	1,060,281
Passengers carried per car-mile	5·73
Traffic revenue per car-mile	15·65d.
Average fare per passenger	2·73d.
Expense ratio	56·62%
Number of cars	14

Bournemouth and Poole Electricity Supply Co., Ltd.

Dr. J. A. Hosker presided at the meeting held on the 18th inst. at Moorgate Court, E.C. In proposing the adoption of the report (see Electrical Review, March 12th, page 443), he said that, in spite of the falling off in the net revenue and the consequent reduction in the dividend on the ordinary shares, it would be found that the results obtained were, considering all the difficulties and drawbacks of the past year, satisfactory. There had been an increase in the receipts from sale of current and meter rentals of practically £1,500, and an increase of 145,181 in the number of units sold and of 21,344 30-watt lamps in the lamps applied for. They were placing slightly more to reserve and depreciation than in the previous year, and they were carrying forward the same amount as before. He was of opinion that the return for last year did not represent a halt in the prosperity of the company, but was simply marking time owing to the exceptional circumstances that had obtained. There was no evidence whatever that Bournemouth was declining, and that, therefore, the company was declining. As they were aware, metallic-filament lamps had come on the scene, and that, together with the serious trade depression that existed, had had a prejudicial effect on their business. Bournemouth was a town that possessed no local industries—it was dependent upon the suffrages of the public, and as one who had lived there for upwards of a quarter of a century, he had never known the place to have been so quiet as it was last November and December. Turning to the accounts, the share capital remained the same as last year, but the 4½ per cent. debenture stock had been increased by an issue of £37,500. That was issued to the shareholders and debenture-holders last May at a premium of 30s. per cent., and he was glad to say that the issue was a complete success, the whole of the stock being duly allotted. The leasehold and special redemption account had been increased by £1,496, and £3,000 had been carried to reserve for depreciation, repairs, renewals, &c., bringing that account up to £21,454. The amount expended on capital account during the year was £11,300, which was considerably less than in 1907, when £31,030 was expended under that head. He did not anticipate any additional capital expenditure as far as Bourne Valley was concerned, for some years to come. Probably in two or three years they might have to spend some more money on machinery at Christchurch, because that station was getting somewhat loaded up, and being worked on the direct-current method it was not affected so much by the metallic-filament lamp. The bulk of the £11,300 expended last year was in respect to mains extensions; the exact figure being £7,864 against £14,937 in the previous year. They obtained 465 new customers last year, most of them of a very good class. A further £10,000 had been advanced to the Richmond company on loan. The total works cost had been 1·286d. per unit generated, a decrease of ·05d. from the figures for 1907, despite the fact that coal had increased by 7½d. per ton. The maximum demand showed an increase of 2½ per cent., and the output an increase of 5 per cent. The average price obtained per unit had fallen from 3·928d. in 1907 to 3·839d., which pointed to the fact that they had been supplying more current for the purpose of cooking and heating. The rate of increase in their sales of current was not equal to that of previous years. That was mainly due to the adoption of the metallic-filament lamp, but was not a matter which need cause the shareholders any alarm. The reduction of revenue due to that cause was common to all companies, and although the lamp must for the time being affect their revenue, he believed that in the long run it would bring them a compensating reward in the form of new business. As to the Richmond Co., the reduced dividend was due in that case to the introduction of the metallic-filament lamp, which had had a greater effect upon the revenue than in their own company, because there was not the field for expansion there that there was at Bournemouth. Regarding the future, he did not care to prophesy—all he would say was that up to date they had connected 87 fresh consumers to their mains as against 80 at the corresponding period last year. Bournemouth was returning to an era of prosperity; the town was getting very full indeed, which should lead to an increased demand for light.

Mr. F. W. Reynolds seconded the motion, and the report was adopted.

Windermere Electricity Supply Co., Ltd.—The report states that the gross revenue for the year shows an increase of £138, but the working expenses, unfortunately, show an increase of £290, caused mainly by the larger quantity of coal consumed. The turbine, which has been in use for 15 years, is in a very unsatisfactory condition, and Messrs. W. Gunther & Sons, of Oldham, are supplying a new turbine, which should be fixed and in working order early in April. A payment of 3 per cent. on account of arrears of interest has been received on the Keswick Electric Co.'s debentures, and the net revenue account has been credited with £57 from this source, and the arrears of interest due from the Keswick Co. have been reduced by £226. The amount spent on capital account during the year is £1,646, including £1,391 for the new engine and alternator, and £142 in mains. The capital expenditure for the ensuing year is likely to be a much smaller sum. The balance of revenue account for the year is £1,910. The directors recommend a further dividend of 1½ per cent. (making 2½ per cent. for the year) on the preference shares, leaving £33 to be carried forward.

Companies Struck Off the Register.—The following have been struck off the register and are dissolved:—

British Blahnik Arc Light Co., Ltd.
Electrical Investment Syndicate, Ltd.

Newmarket Electric Light Co., Ltd.—Mr. F. E. Gripper presided at the annual meeting, held last week, and explained the causes of the slight reduction in revenue, compelling a drop of 1 per cent. in the dividend recommended. The report (see Electrical Review last week) was adopted.

Stock Exchange Notices.—The Committee have appointed a special settling day as under:—

Tuesday, April 6th.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—12,500 5 per cent. cumulative preference shares of £10 each, fully paid, Nos. 1 to 12,500.

And ordered these securities to be quoted in the Official List.

Applications have been made to the Committee to appoint a special settling day in, and to grant a quotation to—

South London Electric Supply Corporation, Ltd.—£100,000 5 per cent. first mortgage debenture stock.

And to allow the following securities to be quoted in the Official List—

Auckland (City of).—£50,000 electric power additional loan 4 per cent. debentures of £100 each, Nos. 1 to 500 (renewed application).

Buenos Ayres Lacroze Tramways, Ltd.—Further issue of £200,000 5 per cent. first mortgage debenture stock.

County of London Electric Supply Co., Ltd.—Further issue of 1,179 6 per cent. cumulative preference shares of £10 each, fully paid.

Germany.—The Gesellschaft fur Elektrische Unternehmungen, of Berlin, is declaring a dividend of 8 per cent. for the last financial year, the same as for the preceding twelve months. It is proposed to increase the capital of the company from £1,875,000 to £2,250,000, the new shares being offered to the old shareholders at a premium of 15 per cent.

Metropolitan Electric Tramways, Ltd.—The directors recommend a dividend of 4½ per cent. on the ordinary shares for 1908.

Shawinigan Water and Power Co.—A dividend of 1 per cent. for the quarter to March 31st is announced.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Mar. 17	2,233	— 51	42	57,190	— 152	..	..
Ayr	,, 20	336	— 27	44	12,585	— 314	8	..
Bath	,, 17	1,088	— 96	11	6,354	+ 144	..	..
Belfast	,, 19	6,865	— 205	51	184,339	— 208	37	..
Birkenhead	,, 21	1,887	— 58	51	53,552	+ 197	18·52	..
Birmingham Corp.	,, 13	12,176	— 406	50	317,165	+ 7,067	..	..
Blackpool-Fleet w'd	,, 19	417	+ 29	9	2,147	+ 229	..	..
Bolton	,, 7	3,885	— 215	49	111,400	+ 1,386	26	..
Bournemouth ..	,, 18	2,481	— 886	50	79,311	— 4,062	21·96	..
Bradford	,, 13	7,911	— 783	49	227,856	+ 847	54·9	..
Brighton	,, 21	1,292	— 52	50	44,749	+ 858	9·5	..
Bristol	,, 19	9,156	+ 253	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 12	393	— 41	10	2,149	— 23	3·65	..
Barnsley	,, 12	289	— 37	,,	1,591	— 21	..	..
Barrow	,, 12	353	— 73	,,	1,965	— 166	5·37	..
Cavehill	,, 12	88	— 24	,,	525	— 39	..	..
Devonport ..	,, 12	614	— 185	,,	3,727	— 415	8·85	..
Gateshead	,, 12	1,867	— 38	,,	9,664	— 100	11·25	..
Gravesend	,, 12	323	— 41	,,	1,717	— 131	6·5	..
Greenock	,, 12	836	— 94	,,	4,327	— 232	7·25	..
Hartlepool	,, 12	360	— 34	,,	1,919	— 250	6·72	..
Kidderminster ..	,, 12	140	— 29	,,	762	— 72	..	..
Leamington	,, 12	235	— 31	,,	1,332	+ 43	..	..
Merthyr	,, 12	357	— 27	,,	1,925	+ 2	2·9	..
Metropolitan ..	,, 12	9,175	— 296	,,	51,561	+ 4,937	22	..
Middleton	,, 12	507	— 111	,,	2,.95	— 161	8·5	..
Mid. Joint Com'tee	,, 12	11,714	—1,907	,,	61,415	— 2,368	..	..
Oldham—Ashton	,, 12	952	— 100	,,	5,103	— 415	9·13	..
Peterborough ..	,, 12	169	— 31	,,	905	— 115	5·31	..
Potteries	,, 12	3,246	— 413	,,	17,020	— 992	29	..
Rothesay	,, 12	82	— 10	,,	435	— 22	2·75	..
Southport	,, 12	368	— 90	,,	2,119	+ 90	8·17	..
S. Metropolitan ..	,, 12	1,158	— 222	,,	6,318	— 45	..	..
Swansea	,, 12	1,660	— 83	,,	8,468	+ 221	12·5	..
Tynemouth ..	,, 12	230	— 26	,,	1,250	— 125	3·75	..
Weston-s-Mare ..	,, 12	57	— 5	,,	246	+ 4	3	..
‡Worcester ..	,, 12	415	— 46	,,	2,225	— 85	5·75	..
Wrexham ..	,, 12	160	— 20	,,	863	— 12	..	..
Yorks. Wool. Dist.	,, 12	1,410	— 275	,,	8,184	— 804	17	..
Miscellaneous ..	,, 12	320	— 27	,,	1,754	— 103	..	..
Burnley	,, 6	2,176	— 152	..	..	..	..	..
Burton-on-Trent ..	,, 21	460	..	51	13,378	— 726	10	..
Bury	,, 21	2,055	+ 2	50½	57,450	+ 1,561	..	..
Cardiff	,, 20	3,746	— 27	51	107,504	+ 209	..	..
Chatham and Dist.	,, 18	1,205	+ 18	11	7,285	+ 574	14·98	2·77
Cork	,, 18	773	— 12	11	4,429	+ 105	..	..
†Croydon	,, 18	1,139	— 106	50	68,431	— 530	11·25	·75
Darlington	,, 20	360	— 6	51	9,848	— 777	..	..
Darwen	,, 19	426	— 29	50	12,349	— 375	4·86	..
Dover	,, 18	273	— 25	50	10,217	— 485	4·75	..
Dublin	,, 19	9,369	— 368	..	52,888	— 455	54·25	..
Dundee	,, 17	2,144	+ 36	43½	52,046	+ 1,959	15	..
East Ham	,, 20	1,739	+ 126	51	44,649	— 497	8·43	·68
Exeter	,, 19	692	+ 21	51	15,451	+ 396	5·5	..
Glasgow	,, 20	32,138	—1,157	..	710,243	—15,445	90·5	1·5
Hastings	,, 19	1,384	— 128	..	..	..	..	..
†Huddersfield ..	,, 18	2,718	— 147	..	77,852	— 490	..	..
Hull	,, 20	4,686	+ 80	51	125,133	+ 461	13	..
Ilkeston	,, 17	245	— 12	50	6,826	— 129	..	..
Ipswich	,, 20	560	— 26	51	19,103	— 425	10·5	..
Kilmarnock ..	,, 13	252	— 22	48	6,452	— 314	4·25	..
Lan'kshire Trm. Co.	,, 18	2,158	— 280	11	14,028	— 781	..	..
Lancashire United	,, 17	2,220	— 31	11	12,779	+ 151	..	..
Leeds	,, 13	11,348	+ 718	45	323,394	+ 2,246	96·75	·25
Leicester	,, 20	4,086	— 7	..	..	..	..	..
Leith	,, 18	906	— 56	43	22,463	+ 23	6	..
Liverpool	,, 18	19 598	—1,357	10½	105,063	— 454	104	..
‡L.C.C.	,, 6	59,801	— 348	..	1,685,505	+177,771	121	4·25
London United ..	,, 20	9,614	—1,060	..	54,010	— 4,028	..	..
Manchester	,, 20	27,216	— 436	51	755,948	+14,818	90·5	6
Newcastle	,, 20	7,370	+ 152	51	197,389	— 7,349	..	..
†Newport	,, 18	552	— 12	50	31,960	— 1,233	14·5	..
Oldham	,, 21	3,661	+ 72	51	98,378	— 631	23·75	..
Pontypridd	,, 20	723	+ 116	51	19,240	+ 5,047	5·5	1·75
†Portsmouth	,, 20	1,468	+ 30	47	91,350	— 1,516	14·5	..
Preston	,, 17	1,249	— 45	..	..	..	..	..
Rotherham	,, 18	1,053	— 114	50½	30,354	— 234	10	·66
Salford	,, 15	7,902	— 546	50	227,341	— 1,364	..	..
Sheffield	,, 21	10,288	— 195	51½	282 886	— 4,409	37	1·25
Southampton ..	,, 17	1,659	— 92	50	52,309	+ 1,401	..	..
Southend-on-Sea ..	,, 17	524	— 8	51	21,324	+ 2,014	..	..
†South Shields ..	,, 13	481	— 1	..	27.481	— 3.8	..	..
Tyneside	,, 17	707	+ 31	11	4,018	+ 122	..	..
Wallasey	,, 13	1,498	— 2	49½	48,468	+ 2,438	..	·22
Walthamstow ..	,, 20	962	— 35	51	30,937	+ 1,292	9	..
West Ham	,, 11	3 670	— 480	50	108,802	— 4,871	15	·3
Wolverhampton ..	,, 17	1,331	— 172	50	40,669	— 1,598	..	..
Baker St.-Waterloo	,, 20	6 825	+ 795	11	37 835	+ 3,960	4·25	..
Cen. London Rly...	,, 20	11,323	— 141	11	62,049	— 5,254	..	..
Char. +, Rus. Hamp.	,, 20	7,545	+1,250	11	42,000	+ 7,410	7.75	..
City & S. Lon. Rly.	,, 21	6,748	+ 209	11	37,612	+ 685	7·3	..
Dublin-Lucan Rly.	,, 19	202	— 7	11	1,169	+ 95	7	..
G.N. and City Rly.	,, 20	3,115	— 233	11	17,561	— 2,176	3·5	..
G.N., P'dy. & Brmtn.	,, 20	11,865	+1,150	11	64,895	+ 5,565	9·25	..
L'pool Overh'd Rly.	,, 21	2,419	— 251	11	15,407	— 1,118	6·8	4·3
Mersey Railway ..	,, 20	3,880	..	11	21,374	+ 584	4·5	..
Metropolitan Rly.	,, 21	80,797	+ 566	11	173,274	+ 5,221	24·5	..
Met. District Rly...	,, 20	19,215	+1,605	11	107,366	+ 8,856	24	..
Anglo-Argentine ..	,, 18	56,127	+18,461	11	292,609	+ 91,350	..	..
§Auckland	Feb. 26	13,787	+1,790	8	28.163	+ 2,230	..	..
Bombay (B.E.T.) ..	,, 18	5,218	+ 558	7	17,661	+ 946	..	..
Calcutta	Mar. 20	6,771	+ 531	..	..	..	..	..
§Geneva	Feb.	6,527	+ 401	..	..	..	..	..
§Kalgoorlie, W.A...	,,	3,403	..	8	7,123	..	..	..
Madras	Mar. 15	1 246	— 161	10	6, 93	— 69	..	..
Perth (W.A.) ..	,, 14	2,856	— 108	..	16,666	+ 81	..	..

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

Menace of war in the Near East having become less threatening, Stock Exchange markets once more plucked up courage, and put prices better. That the general conditions are tempting to buyers cannot be said yet with any assurance of further improvement, for the hornet's nest in the Balkans will take a long time to settle down into even a normal state of restlessness, and there will be intermittent scares for some weeks to come. Nevertheless, it is good to have a brighter outlook, and prices were quick to respond to the more pacific nature of this week's cables.

The strike of telegraphists and other Post Office servants in Paris led to less inconvenience in the Stock Exchange than to many other sections of the business community. While the sensation-mongers in the papers were describing how not a message was being got through on a certain day, the Stock Exchange and the Paris Bourse were in communication all the time, and the service has worked admirably. There are four telephone lines working between the London Stock Exchange and the Paris Bourse, but it is seldom that they are all in operation. During the strike the service came down to one line for a bit, but not for long.

Telegraphic and letter advices were, of course, greatly retarded and maledictions were rained upon the Paris Post Office. But instances of serious inconvenience have been few, and the incidents are now subjects for jest rather than Parliamentary language.

Electricity Supply shares are steady to firm. Westminsters and St. James's have hardened. Hove shares and Oxfords are both better. On the other hand, Newcastle-on-Tyne Preference are ½ lower.

By regrettable accident the South London Electric Company's shares were here quoted last week in a short list of *ex* dividend markings, whereas the figures given were those of the South Metropolitan Electric Light and Power Company. The former concern last paid 5 per cent. on its shares, and there is no preference issue. The slip was so patent that we should not have thought of mentioning it had we not been most courteously requested to do so.

The American electricity group has been much quieter and movements are comparatively mild. Rio Trams, with a gain of 2½, rose to 100, recovering about half their fall of last week. Mexico Trams are without net change, while Mexican Light and Power is ½ better, though the Preference shows a fall of 1. Sao Paulo Trams fell 2. Canadian General at 108½ is 1½ lower. The various 5 per cent. bonds are all fairly steady, and Monterey Railway, Light and Power 5 per cent. First Mortgage Debenture stock has been changing hands at 85½.

London United Tramways Preference shares are flat, on the decision of the directors, already noticed here, to limit the dividend on the Preference to 2½ per cent. per annum for the present. These £10 fully-paid shares now stand no higher than 3⅝, and the 4 per cent. debenture stock is down 2 to 76½. British Electric Traction are also flat, the Preference being another 5s. lower, and the Debenture stocks both showing losses. Brush Preference have sunk to the inglorious price of nothing to an eighth. Edison & Swan "A" £3 paid shares are ⅛ lower at 10s. middle.

Business in Great Northern & City Railway Preferred shares has been done this week at 4s. 9d. and 5s., from which it would appear that the recent buyer who gave 10s. treated the seller generously. On balance, the electrical railway issues are dull. Metropolitan Consolidated and Surplus Lands stocks fell a point apiece. Central London Ordinary is 1 down, but City and South London rose 10s. Underground Electric Railways' 6 per cents. are another ½ better. Great Northern, Piccadilly & Brompton 4 per cent. Debenture is steady at 92, Charing Cross Debenture keeps at about a point less, and "Bakerloo" Debenture is well established at 96.

Stagnation is the only word applicable to business in telegraph issues. West Coast of America shares are ½ down, and this is the solitary alteration for record. Globe Preference moved down ½. American Telephone and Telegraph capital stock eased off ½, and National Telephone Deferred is 1½ easier, a few holders selling, now that the price is *ex* dividend and there is not much left "to go for" at present. Monte Video Telephone Preference have regained the greater part of their relapse.

Callender's are 5s. to the good, but other movements in the manufacturing list are mainly downward. Crompton Debentures shed a point. British Aluminium 7 per cent. Preference are ½ down, and Willans & Robinson Preference, at 2½, are nominally 6s. 3d. lower. Thanks to the Navy scare, shares in such companies as Babcock, Vickers and Armstrongs have been in demand. There is also a better tone for rubber shares.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Mar. 16th.	Closing Quotations Mar. 23rd.	Business done week ended Mar. 23rd, 1909. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	92 — 95	92 — 95	..	..	..	5 6 5
$131,551,400	American Telephone & Telegraph, Cap. Stock	$100	7¼%	8 %	8 %	..	131½ —132½	132 —133	133⅜	..	+ ½	6 0 4
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
598,180	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	55 — 58	55 — 58	56½	55½	..	5 5 3
3,200,910	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	99 —101	99 —101	100½	99½	..	5 18 10
3,200,910	Do. do. do. Deferred	Stock	½%	1½%	1 %	8/-	13⅛ — 13⅜	13⅜ — 13⅝	..	..	+ ¼	2 19 3
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	98 —100	99 —100	..	..	+ ½	5 0 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7⅞ — 8⅜	7⅞ — 8⅜	..	..	..	4 15 6
2,431,350	Commercial Cable Stng. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87½	87	..	4 13 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	..	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	6 6 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½ — 17½	16½ — 17½	..	..	..	5 14 3
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8 — 8¼	8 — 8¼	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	8 16 6
60,710‡	Direct United States Cable	20	4½%	4½%	4½%	4½%	12½ — 12⅝	12½ — 12⅝	..	..	..	6 9 3
48,000‡	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	128 —131	128 —131	129½	128	..	5 6 10
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	..	85 — 87	85 — 87	85½	..	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103½ —105½	103½ —105½	104½	104	..	3 17 8
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	..	11⅛ — 12⅛	12 — 12⅛	12⅛	11⅞	..	5 13 4
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	100 —102	100 —102	101⅛	100⅜	..	3 18 5
200,000‡	East & S. Afric. Tel., 4 % Mt. Db. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100½ —102½	100½ —102½	..	..	..	3 18 1
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10½ — 10⅝	10½ — 10⅝	10⅝	10 7/16	..	5 9 8
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	13 — 13½	12⅝ — 13⅜	13 1/16	13	— ⅛	4 9 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	..	80 — 82	80 — 82	..	..	..	6 5 0
14,000‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,900, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	..	52 — 55	52 — 55	..	..	..	6 18 11
$41,880,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	70 — 77 xd	74 — 78	..	..	..	5 3 11
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	70 — 75 xd	71 — 74	..	..	..	5 6 8
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3/16 — 7/16	..	16/6	16/3	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	3/4 — 7/8	3/4 — 7/8	..	..	..	6 0 9
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	..	..	+ 1/16	5 12 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	105½ -107½ xd	105⅝ -107½	106½	106⅜	..	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	118 —120 xd	116½ —118½	119	116½	—1½	5 1 3
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 11½ xd	10½ — 11½	..	..	..	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10½ — 11½ xd	10½ — 11½	..	..	..	5 6 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 1/16 — 5 3/16 xd	5 1/16 — 5 1/16	5 1/16	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 100	..	..	..	3 10 0
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99½ —101½	99½ —101½	100½	100½	..	3 18 10
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 17 3
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	..	1⅜ — 1½	1⅜ — 1½	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	90	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,889‡	Reuter's	8	5 %	5 %	5 %	..	7½ — 8¼	7½ — 8¼	..	..	..	4 17 7
99,100	Telephone Co. of Egypt, 4½ % Deb. Red. ..	100	4½%	4½%	4½%	4½%	99 —101	99 —101	99½	..	..	4 9 1
8,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6½ — 7	6¾ — 7	..	..	..	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4⅝ — 5⅜	4⅝ — 5⅜	..	..	..	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1⅜ — 1⅝	1⅜ — 1⅝	30/-	..	— ⅛	3 16 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	12⅞ — 13⅜	12⅝ — 13⅜	13⅛	12 13/16	..	5 4 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	101½	101	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	7⅛ — 8⅛	7⅛ — 8⅛	..	..	..	7 3 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	..	7⅛ — 8¼	7⅛ — 8⅜	..	..	..	2 14 1
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

930,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,006 to 580,097	5	8 %	8 %	9 %	..	8⅛— 9 1/16	8¼— 9⅛	9	8 31/32	— 1/16	4 18 8
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5⅛%	5⅛%	5⅜%	..	5⅛ — 6 1/16	5⅛ — 6 3/16	6⅛	6 1/16	..	4 12 4
266,600	Do. Old, 6 % Deb. Stock, 1888 ..	100	6 %	6 %	6 %	6 %	..	..	..	..	..	4 4 6
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	..	4⅜ — 4⅝	4⅜ — 4⅝	88/9	85/7½	..	4 13 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16 — 1 5/8	1 7/16 — 1 5/8	..	..	..	3 13 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	..	1⅝ — 2	1⅝ — 2	32/6	..	..	17 10 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	3⅜ — 3⅝	3 — 3⅛	..	..	— ⅛	10 14 11
40,100	Do. do. "A" 6 % Cum. Pref. ..	5	6 %	6 %	6 %	6 %	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	7 1 2
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¼ — 4¼	3¼ — 4¼	..	..	..	4 8 11
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 98	96 — 98	..	..	..	5 12 3
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	138 —141	140 —143	142½	..	+2	5 11 11
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	120 —124	120 —124	121	..	..	4 16 9
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	105 —107	105⅛ —107½	106½	105½	+ ½	4 13 0
388,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102½ —104½	102½ —104½	..	..	..	10 15 3
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
188,301	British Electric Traction	10	3 %	Nil	Nil	..	1⅛ — 1⅜	1 1/16 — 1 1/16	..	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	..	2⅜ — 2⅝	2⅜ — 2⅝	60/-	52/6	— ⅛	9 4 7
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	89 — 94	88 — 93	90	..	—1	5 6 5
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	73 — 75	70 — 75	..	..	—1½	6 0 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅛	6 — 6⅛	..	..	..	4 14 1
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
208,440	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	39 — 44	39 — 44	..	..	..	9 1 10
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	..	0 — ¼	0 — ¼	3d.	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	..	1/16 — 1/8	0 — ⅛	6d.	..	— 1/16	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	..	57 — 62	57 — 62	..	..	..	7 5 2
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	..	33 — 38	33 — 38	..	..	..	10 16 10
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	..	4⅜ — 5	4⅜ — 5	..	..	..	6 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	5 %	5 %	5 %	5 %	4⅜ — 5⅜	4⅜ — 5⅜	..	..	..	4 13 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	99 —102	99 —102	100	..	..	4 8 3
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9¼ — 10¼	9½ — 10½	..	..	+ ½	7 2 10
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,229	Cape E Trams., 1 to 491,229	1	Nil	Nil	Nil	..	3/16 — 5/16	3/16 — 5/16	5/9	5/-	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	6 17 2
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	103 —107	103 —107	..	..	..	4 4 1
1,898,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	63 — 65	62 — 64	62⅝	62½	—1	5 1 7
558,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	82 — 84	82 — 84	83½	83½	..	4 15 3
558,195	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	45 — 47	45 — 47	..	..	..	5 2 0
1,480,000	City and South London Railway	Stock	1½%	2½%	2½%	1½%	27 — 28	27½ — 28½	28	27½	+ ½	5 5 3
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	1 — 1½	1 — 1½	22/6	20/7½	..	11 2 2
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 98	..	..	— 1	5 2 0

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations Mar. 16th.	Closing Quotations Mar. 23rd.	Business done week ended Mar. 23rd, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 1/2 — 1 5/8	1 5/8 — 1 3/4	..	..	..	4 16 0
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6 %	6¼%	6 %	11⅛ — 12⅛	11⅛ — 12⅛	..	..	..	4 16 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12⅜ — 13⅛	12⅜ — 13⅛	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	4½%	4½%	..	1 7/16 — 1 9/16	1 7/16 — 1 9/16	..	..	— 1/16	20 0 0
17,189	Do. "A" shares, 01—017,189	5	4½%	4½%	4½%	..	2 — 2⅛	1⅞ — 2⅛	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	75 — 78	75 — 78	..	..	..	5 2 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	86 — 89	86 — 89	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	5/16 — 9/16	5/16 — 9/16	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1⅜ — 1½	1⅜ — 1½	..	..	..	9 6 9
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7/8 — 1	7/8 — 1	..	..	..	6 9 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 89	85 — 89	..	..	..	4 9 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	⅛%	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	3 6 8
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10⅝	10½ — 10⅝	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —108	102 —108½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11⅛ — 12⅛	11⅛ — 12⅛	..	..	..	6 0 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10%	10 %	10 %	..	15 — 16	15 — 16	..	..	..	6 5 0
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	⅛%	Nil	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ — 5½	4½ — 5½	..	..	..	9 10 6
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	..	6⅛ — 6⅜	6⅛ — 6⅜	..	..	..	4 8 11
899,980	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	..	6⅛ — 6⅜	6⅛ — 6⅜	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3⅜%	4⅛ — 4⅜	3⅞ — 4⅛	..	..	— 3/8	8 6 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	77 — 81	74 — 79	75⅞	75	—2⅝	5 1 3
5,782,062	Metropolitan Consolidated	100	2⅜%	1 ⅜%	⅜%	35 — 36	34 — 25	85	84½	—1	1 8 6	
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	69 — 71	68 — 70	68⅛	..	—1	3 18 7	
8,285,000	Do. District	100	Nil	Nil	Nil	Nil	13⅜ — 14	13⅜ — 14	14 1/16	13⅜	..	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	1½ — 1⅝	..	..	..	..	..	..
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	33/64 — 37/64	33/64 — 37/64	15/6	14/6	..	5 19 5
600,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	94 — 96	96⅜	..	+ ⅜	4 13 9
$6,000,000	Mexico Trams Co., Common Stock	..	..	..	..	..	134—136	134—136	136¼	132½	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	90¼— 91½	90⅜— 91½	91½	91	+ ½	5 9 0
245,500	Potteries E. Trc.	1	4 %	4 %	4 %	4 %	1 — 1⅛	1 — 1⅛	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1 — 1⅛	1 — 1⅛	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	88 — 91	89 — 91	..	..	..	4 18 11
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	32 — 34	32 — 34	33	32½	..	5 14 10
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	99⅛—100⅜	100⅛—101⅛	100⅞	100⅛	+1	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	81 — 83	81 — 83	..	..	..	5 9 9
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	27 — 29	27 — 29	..	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	Nil	10 %	..	5/8 — 7/8	5/8 — 7/8	..	..	..	10 0 0
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	Nil	..	6 %	..	2⅜ — 2½	2 — 2⅛	46/3	..	— ⅜	12 0 0
246,404	Do. 4 % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	..	4⅜— 5	4⅜— 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
30,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10 %	8⅝— 8⅞	8⅝— 8⅞	..	..	..	5 15 11
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8¼	8 — 8¼	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 — 102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞— 4⅛	3⅞— 4⅛	..	..	..	5 14 3
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛— 4⅜	4⅛— 4⅜	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞— 4⅛	3⅞— 4⅛	..	..	..	5 9 1
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝— 4	3⅝— 4	..	..	— 1/16	5 12 6
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	103½	..	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅛ — 11	10⅛ — 11	..	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12⅛ — 13	12⅛ — 13	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —123	121 —123	..	..	..	4 1 4
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2⅜— 3	2⅜— 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	3⅜— 3⅝	3⅜— 3⅝	..	..	..	6 13 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	96 — 98	96 — 98	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8⅞ — 9⅛	8⅞ — 9⅛	8⅞	..	..	5 9 7
50,597	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	11⅛	10⅞	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108	106 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	3/16 — 5/16	1/8 — 1/4	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	3/16 — 5/16	1/8 — 1/4	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59 — 62	59 — 62	14/-	..	..	7 0 8
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	83 — 85	84 — 86	84½	..	+ 1	5 16 3
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4⅛ — 5	4⅛ — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	..	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6⅞ — 7⅛	7 — 7⅛	..	..	+ ⅛	5 13 4
$2,400,000	Kaministaquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	96⅛— 98⅜	96⅜— 98⅝	98	97⅜	..	5 0 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7⅛ — 7⅛xd	7⅛ — 7⅛	..	..	..	6 1 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 96	93 — 96	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅛ — 2⅛	1⅛ — 2⅛	37/6	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5⅜	5 — 5⅜	5⅛	..	..	5 11 8
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 96	92 — 96	94½	94	..	4 3 4
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6%	5 %	4⅛ — 5 xd	4⅜ — 5	96/-	91/3	..	6 3 10
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅛ — 5	4⅜ — 5	..	..	..	4 10 0
230,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	85 — 88	85 — 88	..	..	..	3 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	86 — 87	86 — 87	86	..	..	5 14 11
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	76 — 78	76⅛ — 77⅛	78½	77	..	4 9 9
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	109 —111	108 —110	..	..	—1	6 7 3
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	89½— 90½	89 — 90	89⅞	89½	— ½	5 11 1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	..	3⅜— 4⅛	3⅜— 4⅛	82/6	..	..	9 8 3
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	..	5 — 5⅛	4⅞— 5⅛	..	..	— ⅛	4 18 0
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	100 —102	100 —102	..	..	..	..
10,859	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	10⅜— 12½xd	10⅜— 11⅞	11½	..	..	6 5 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	5⅞— 6¼xd	6 — 6¼	6¼	6⅛	+ ⅛	5 12 0
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	..	..	1⅜— 1⅝	1⅜— 1⅝	..	..	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6	6	6	..	1⅜— 1⅝	1⅜— 1⅝	21/6	..	..	5 4 4
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	..	5 %	100 —103	100 —103	101½	..	..	4 17 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8⅜ — 8⅝	8⅜ — 8⅝	8⅝	8½	+ ⅛	5 12 8
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6¾ — 7¼	6¾ — 7¼	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	..	5/8 — 11/16	5/8 — 11/16	..	..	..	Nil
46,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 70	68 — 70	..	..	..	5 11 1
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅛ — 2⅜	2⅛ — 2⅜	..	..	..	6 10 4
130,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	⅜ — ⅝xd	⅜ — ⅝	..	..	..	4 0 0
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	24/9	24/-	..	5 12 0
220,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102—105	102 —105	..	..	..	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	⅝— 1	⅝— 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅝— 2	1⅝— 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	78 — 82	78 — 82	82	..	..	5 9 9
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	13/16 — 15/16	13/16 — 15/16	..	..	..	..
110,000	Westminster Electric Supply, Ord.	5	18 %	12 %	10 %	10 %	8⅞— 9	8⅞— 9⅛	9 1/16	8½	+ ⅛	5 8 1
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5⅛— 5⅜	5⅛— 5⅜	5 1/16	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING FEBRUARY, 1909.

The February returns of both exports and imports show considerably reduced totals over the previous month—the February returns, however, cover only 28 days.

The exports for the month totalled some £231,842, including £38,652 of telegraphic material—the latter item being some £17,000 in excess of the January figure. Deducting telegraphic exports, the February returns of exports show a total of £193,190, as compared with £227,936 in the previous month, and the 1908 average of £213,000, when telegraphic material was not included in the returns.

The import total for the month stands at £131,774, as compared with £155,951 in January, and the re-exports at £15,383 are some hundreds to the good on that month's total.

Of the individual returns which, generally speaking, show some reduction on the January totals, the machinery exports amounted to approximately £97,000; cable exports reached £38,337; and telephonic material amounted to £16,183.

Machinery imports totalled some £24,000, and electric lamps, which have for some time occupied the premier position in the import section, fell from £58,674 in January to £45,887 in February.

No particular changes occurred in the purchasing or importing countries, but it is interesting to note that Germany supplied nearly 60 per cent. of the electrical material entering this country.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	49	...	105	67	83	529	167	...	...	15	8,374	9,389
Germany	469	3,400	...	...	93	722	...	...	...	33	182	4,899
Netherlands	260	449	...	21	89	432	...	...	34	65	...	1,350
Belgium	58	343	12	...	304	867	4	34	...	589	...	2,211
France and French Indo-China	80	8	613	746	18	1,222	3	...	...	7	13	2,710
Switzerland	11	...	...	...	...	144	...	...	...	8	...	163
Portugal, Madeira, Azores & Portuguese Africa	48	198	...	75	3	1,599	...	79	...	41	778	2,821
Spain and Canary Isles	36	...	31	441	6	599	...	29	13	36	376	1,567
Italy and Austria-Hungary	207	...	13	185	1,009	1,561	300	...	...	...	...	3,275
Greece, Roumania and Turkey	44	80	21	23	...	25	...	37	...	11	119	360
Channel Isles, Gibraltar and Malta	16	53	28	73	45	71	...	...	...	...	104	390
U.S.A., Cuba and Philippines	168	...	...	...	84	...	...	30	...	28	5,428	5,738
Canada and Newfoundland	197	2,117	40	...	145	1,232	1,400	73	...	1,182	65	6,451
Bahamas, Brit. West Indies and Brit. Guiana	25	121	8	34	...	102	...	4	11	12	188	505
Mexico, Salvador and Panama	...	27	...	...	...	134	...	...	...	...	247	408
Peru and Uruguay	138	...	...	49	...	703	...	8	...	39	41	978
Chile	92	166	468	188	...	4,169	...	56	...	162	247	5,548
Brazil	78	576	163	345	399	4,185	777	60	11	21	11,780	18,395
Argentine	313	2,805	152	713	28	2,795	610	266	153	1,419	2,896	12,141
Egypt, Tunis and Morocco	243	368	68	112	...	552	...	130	...	258	18	1,749
British West Africa and St. Helena	32	41	...	...	84	38	...	5	...	126	156	482
Cape of Good Hope	151	831	222	160	33	1,847	...	19	26	...	242	3,531
Natal	628	2,364	32	266	152	1,959	2	5	...	127	33	5,568
Transvaal, Orange River Colony and Rhodesia	759	447	27	284	7	370	...	...	12	62	...	1,968
Zanzibar, Brit. East Africa, Mauritius, & Aden	...	...	46	...	115	59	21	...	...	58	50	349
China and Siam	1,415	1,726	213	455	520	1,202	271	70	13	55	213	6,153
Japan and Korea	350	4,526	216	89	1,148	7,077	17,588	467	51	3,085	1,181	35,778
Java and Dutch Indies	35	...	...	...	...	323	...	21	...	...	11	390
India	4,581	9,585	2,275	1,471	830	16,835	966	2,165	328	446	3,342	42,824
Ceylon	43	500	57	106	85	329	...	2	...	27	95	1,244
Straits Settlements, Fed. Malay States and British North Borneo	204	1,541	5	148	206	1,115	3	10	...	102	47	3,381
Hong Kong	333	755	150	416	...	4,669	588	...	...	...	57	6,968
West Australia	198	78	14	287	...	928	...	32	...	907	158	2,602
South Australia	462	47	37	...	43	295	48	...	...	549	...	1,481
Victoria	618	1,564	55	350	495	884	...	649	22	4,242	578	9,457
New South Wales	1,592	1,008	272	1,257	800	9,106	...	387	...	35	...	14,457
Queensland	...	116	15	...	...	220	...	...	...	69	...	420
Tasmania	22	...	...	...	140	...	31	4	...	32	...	229
New Zealand	312	2,497	506	380	5	5,289	255	291	...	2,344	1,633	13,512
Total, £	14,267	38,337	5,864	8,741	6,969	74,188	23,034	4,933	674	16,183	38,652	231,842

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	£
Norway, Sweden and Denmark	18	...	...	80	...	888	120	383	328	4,924	6,741
Germany	850	8,827	1,768	41,693	2,336	12,237	61	864	4,140	4,722	77,498
Holland	...	227	...	2,588	27	126	...	120	38	10	3,136
Belgium	620	1,354	238	69	117	576	...	343	443	6,630	10,390
France	118	73	486	649	1,324	69	...	3,879	3,587	2,487	12,672
Switzerland	86	226	12	...	56	533	...	10	143	14	1,080
Italy	501	600	...	...	...	260	120	...	...	1,045	2,526
Austria-Hungary	36	244	...	465	...	21	...	...	1,630	119	2,515
United States	2,339	126	731	343	215	9,093	1,647	524	164	34	15,216
Total, £	4,568	11,677	3,235	45,887	4,075	23,803	1,948	6,123	10,473	£19,985	131,774

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	£	
Various countries, mainly as above	2,414	20	...	2,092	...	4,009	...	433	406	4,126	1,883	...

Total Exports: £231,842. Total Re-Exports: £15,383. Total Imports: £131,774.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

THE REPORT OF THE TARIFF COMMISSION ON THE ENGINEERING INDUSTRIES.

(*Concluded from page* 462.)

Touching on the question of duties, Mr. Hirst is of opinion that in some industries where we are very backward, or in certain sections of those industries, a tariff of something like 50 per cent. would for a time be absolutely necessary. On novelties which the foreigner is making, and which we have not yet got hold of here, a high rate of duty is also required. On ordinary goods 10 per cent. would go a long way, but on brass and china fittings we should require 15 per cent. to 20 per cent. From this we may assume that Mr. Hirst would impose 10 per cent. duty on dynamos and electrical machinery, but it is obvious from his own evidence that this, in the special cases he gives, would be absolutely useless to keep out the foreign machinery.

As regards lamps, Mr. Hirst is very magnanimous. A 10 per cent. duty would satisfy him, as he already has his own factory; but to give other people a chance to start factories in this country he would recommend 25 per cent. to 33 per cent., with a reduction to 10 per cent. to 15 per cent. in three years, as a preventative against trusts. On carbons he proposes a 50 per cent. duty for a number of years, and afterwards a similar reduction to 10 per cent. or 15 per cent. might be sufficient to keep the industry going.

Mr. Madgen, of the Brush Co., prefaces his remarks by saying that his evidence is personal, and not given on behalf of the board of the Brush Co., one or two of his colleagues not being quite in accord with him. He first draws attention to "the extraordinary proportion of the electrical machinery and apparatus in this country which has been manufactured abroad, but which bears the names of companies registered in England, and is, therefore, necessarily supposed to be the result of British labour." No figures appear to be given. He says that a leading German firm trading under an English title advertises that it has over 50 British municipalities among its customers. If Mr. Mordey's figure of 4 per cent. represents anything like the percentage of foreign machinery in British central stations, it is obvious that the company referred to does not do a very big trade with its 50 municipal customers. He confirms the opinions of other witnesses when he says, "that the highest standard of commercial ability is to be found in the British manufacturing centres." He goes on to say :—"In general he is more of a sportsman than a mere money grubber in his business, and submits in silence to much unmerited abuse from the University professors on the one hand and the halfpenny Press on the other." He asks for a duty somewhere between 5 per cent. and 10 per cent., which would not raise prices appreciably, as this would be prevented by internal competition.

Witness No. 248, whose name is not given, points out that four or five years ago Continental and American manufacturers were quoting 20 to 25 per cent. below English tenderers, and this has had the effect of bringing down the English prices. He instances the fact that "a 500-kw. machine which three years ago would have cost £1,300, now costs £900, a reduction of 30 per cent." The users of electrical machinery might be inclined to argue from this that but for foreign competition we might still have been paying £13 for £9 worth of machinery, but this is not an altogether justifiable argument, as there is little doubt that the larger demand for electrical machinery, the competition between home manufacturers, and the improved and more economical methods of production, would have brought about a reduction quite regardless of foreign competition.

This witness then gives other comparisons of English and foreign tenders. Thus, in a recent Cardiff contract the English prices were 17 per cent. higher than the Continental. For Manchester Corporation switchboards, the German offer was 10 per cent. below the English. (The witness means 10 per cent. below the British Westinghouse price, but it was said at the time that the Westinghouse offer was for American manufacture.) At West Ham, for machinery, German offers were 20 per cent. lower than the English; for Bradford car equipments, the foreign offer was 12 per cent. below the English. For St. Pancras machinery the difference was 17 per cent. For an L.C.C. contract, 20 per cent. A colliery in Wales recently placed an order for a 750-kw. machine at a price 25 per cent. below the average English price. Notwithstanding all these wide differences we find that this witness adopts the stereotyped formula :—"If we had a 10 per cent. duty on imports, we should be quite content." He adds, without, however, showing how he arrives at his conclusions, "A duty will have the effect rather of decreasing the price than increasing it." It has been often said that Protection would increase the wages of the British workman, and that the wages of skilled artisans in Germany are as high, or higher, than in this country. This witness's evidence does not bear this out. He gives a list of the rates of wages collected two years ago :—

	English.	Berlin.	Difference per cent.
Leading dynamo erectors ...	9½d. to 12d.	6½d. to 8d.	46 to 50
Fitters	8d.	6d. „ 7d.	14⅓ „ 33⅓
Switch makers	8d.	4½d. „ 5d.	60 „ 77⅔
Armature winders	8d.	6d. „ 7d.	14⅓ „ 33⅓
Core makers	6¾d.	3½d. „ 5d.	35 „ 93
Pattern makers	9d.	4½d. „ 5d.	80 „ 100
Crane attendants	5½d.	4½d. „ 5d.	10
Small commutator makers...	4½d. to 12d.	5½d. „ 6d.	68½
Large commutator makers...	4½d. „ 12d.	6d. „ 7½d.	80
Small dynamo and motor fitters	9d.	6½d. „ 8d.	12½ to 38½

The weekly hours of labour in England are 15 per cent. shorter than at Berlin.

As regards production, this witness says that the production in this country is considerably higher than that on the Continent, and about equal to that of the best shops in the United States, notwithstanding that the shop hours of the British are appreciably shorter. It is, he says, an accepted fact that English dynamo and electrical machinery is more workmanlike and better finished than that imported.

Mr. T. Callender said that the business of his firm had increased during the last ten years from a turnover amounting to £100,000 to £150,000 a year to about £1,000,000. The trade in cables in this country is about £3,000,000 a year. German firms are arranging to fight our trade by the formation of nominal English companies. The Germans did about £200,000 worth of trade, chiefly in the smaller wires in 1907, which represents about 6 per cent. of the home trade. Germans did not produce as high a quality of cable as the British, and, in fact, it is recognised that all British-made cables are superior to foreign. Some of the German work in London has been singularly unfortunate.

Referring to the contract for the District Railway, Mr. Callender says that the English tenders for the first contract varied from £115,000 to £105,000, and the German offer was £90,000. The British competing firms met, and after considerable discussion it was agreed to take the contract at the German price, although it represented an actual loss of £8,000 to £10,000. But when the extension order came along the District Railway gave the work to the Germans because the English firms would not again accept the German prices. In view of the previous statement of Mr. Callender it would appear that the District Co. accepted not only a lower price but an inferior quality of cable, and it would be interesting to know what the English price would be for the same quality. It will also be instructive to watch whether the company reverts to the British manufacturer when again in the market.

Touching on the question of the export trade, more particularly to the Colonies, Mr. Callender says that the absence of trade in electrical material in Canada is due less to the tariff than to the fact that the Americans got hold of it financially before ourselves. In other words, the American companies have financed Canadian companies and got them into their grip. Most of the materials for cable manufacture come necessarily from abroad, as Mr. Callender pointed out. Thus, copper is imported from Australia, Chile and the United States. Most of the lead comes from abroad. The paper is nearly all British-made, as it appears to be better than the foreign. The raw bitumen comes from Trinidad.

On the question of labour, Mr. Callender says that the rate of wages is much less in Germany than it is with us, and that one of the points he grumbles about is that local authorities impose most stringent regulations as to carrying out work under Trade Union conditions of price, time and hours of labour, &c., whereas when orders are placed abroad no such conditions are imposed. This, again, is a question which

can be settled quite apart from any question of duties, and has nothing to do with it. Concerning its injustice to the British tenderer we have written very plainly a score of times.

"Foreign commercial travellers," says Mr. Callender, "do not compare with ours." This does not appear to harmonise with Mr. Hirst's evidence. He, however, confirms Mr. Hirst as regards rates of transport. On the Continent, he says, greater facilities are afforded than here. The railway rates here are exorbitant, but the steamer communication between London and the ports round the coast makes the railway companies a little more reasonable, but does not affect them so much as it ought to do. Mr. Callender gives instances. Thus, to Burnley, in the centre of Lancashire, the railway charge from London is 43s. 9d. a ton, whereas, if shipped to Goole, and by rail from Goole, the price is 21s. 6d., including transhipment. To Liverpool the railway rate is 31s. 6d.; the steamer rate, 16s. 6d. The rate to Reading is 22s. 3d., the same as to Birmingham, although Reading is only 36 miles distant from London, whereas Birmingham is 113, or approximately four times the distance. Mr. Callender points out, however, that the internal rates are not detrimental to us unless foreigners have cheaper through rates.

On the question of technical education, Mr. Callender bears out what other witnesses have said, viz., that technical men have a better education abroad than here, but they are not such practical men. Recently his firm carried out some large work in Copenhagen, a small city compared with Manchester or Liverpool, but the technical staff there is many times larger than we should think necessary here. They are what he would call "*highly trained men working at starvation wages, and not working very hard.*" Mr. Callender does *not* add that Tariff Reform means more work for everybody and better pay.

Touching on the question of rating of machinery, this, says Mr. Callender, has gone up to a shocking extent. Whereas four years ago they paid about £400, they were now paying £2,240. The rate in the pound has increased and they were also assessed higher.

Touching on the question of duties, Mr. Callender thinks if we had a reasonable duty and power to retaliate we should probably come to some arrangement with the Germans. In Germany the prices of similar goods run from 10 to 20 per cent. above ours, "and this," says Mr. Callender, "is *what one would expect, as the duty is from* 12½ *to* 15 *per cent.*" Surely the same remark would apply here, viz., that if we had a similar duty English prices would be correspondingly raised.

We have not space to abstract more fully the evidence of the various witnesses, but a careful perusal of it leads inevitably to the conclusion that Tariff Reform is being largely advocated to compensate for the disadvantages under which British industry suffers by reason, not of Free Trade, but of excessive railway freights, want of standardisation, apathy of the home Government on commercial matters, the craze for sport rather than business among the rising generation, and the higher rates of wages and more comfortable standard of living in England than prevail in Continental Protected countries. In fact, what it is proposed to do is not to attack the root causes of the disease itself, but simply to apply an anæsthetic to deaden the pain. The effect of this would be that the disease would run its course, and the victim become gradually worse, without feeling it very much, until he got beyond possibility of recovery; slow suicide, in fact. Even the Tariff Commissioners can see the futility of this, hence they do not recommend any duties to be imposed on engineering imports.

Neuhausen Aluminium Industry Co.—The directors of the Aluminium Industrie Gesellschaft, of Neuhausen, propose to recommend at the forthcoming meeting the payment of a dividend at the rate of 18 per cent. for 1908, as compared with 20 per cent. in the preceding year. As net profits, the accounts show the sum of £112,830, as contrasted with £214,500 in 1907. A year ago the shareholders approved the allocation of £48,900 out of the profits to a reserve fund for the purpose of equalising dividends in less successful years, and it is now intended to appropriate £12,070 from this fund to assist in paying the rate of dividend at present in contemplation, thus leaving the amount of £36,830 available for a similar purpose in future years.

PROCEEDINGS OF INSTITUTIONS.

High-Speed Signalling in Submarine Telegraphy.

Mr. Sidney G. Brown, M.I.E.E., lecturing at the Royal Institution on March 12th, described a new method of high-speed signalling on submarine circuits by means of his "magnetic shunt" and "drum" cable relay, referring especially to actual traffic tests over the Eastern Telegraph Co.'s cable between Porthcurnow and Gibraltar.

Mr. Brown first dealt with the general difficulties of submarine signalling. A core of any given length, he said, has a certain time rate of signalling, which is inversely proportional to the product of the resistance of the wire and the electrostatic capacity of the core. This is termed the K R, or capacity resistance. There is a critical limit or point to give the lowest K R—namely, when the diameter of the copper to the diameter of the core is in the proportion of 1 to 1·65.

If two cables were constructed of equal K R, but one had a larger copper of half the resistance of the other, then with equal sending batteries the one with the lower resistance would deliver twice the current at the receiving end at the termination of equal times, and could, therefore, be made to work at a faster rate. It should also be a cheaper cable, because copper is less expensive than gutta-percha. Against these electrical advantages must be set the risks due to the reduction of the thickness of the cable, but such mechanical difficulties could be overcome, he thought, by greater care being taken in the manufacture of the cable or by substituting dry cotton, or similar material well impregnated with gutta-percha compound, for the yielding gutta-percha at present used. He would take an Atlantic cable laid in 1894 as having the greatest size of copper for size of core to illustrate the improvement that might result by increasing the copper up to the largest size electrically permissible:—

	1904 *cable.*	*Ideal core.*
Diameter of core	·466 in.	·466 in.
Diameter of cable	·202 in.	·282 in.
Resistance per nautical mile ...	1·684 ohm.	·0864 ohm.
Capacity per nautical mile... ...	0·420 mfd.	0·700 mfd.
K R for 1852 nautical miles ...	2·41 mfd.	2·06 mfd.

The speed of working the "ideal" cable with a sending battery of 40 volts, and with the same duplex system, would be about 240 letters per minute (as compared with 205 letters per minute), and the current received at this speed would be twice as strong as in the actual cable. Indeed, a still greater speed than that given might result, rising, perhaps, to 260 letters per minute.

Referring to the reversal code used in submarine transmission, and to the difficulties due to "distortion," Mr. Brown said that the slower signals get through a cable with more vigour than is necessary. The ingenuity of experimenters had therefore been exerted to retard them, and to assist as much as possible the quicker ones, so that all the signals, whatever their period, should arrive with exactly the same strength.

Cromwell Varley in 1862 patented a system for the reduction of distortion on cables by inserting condensers of suitable capacity in series with the conductor at each end of the cable. The use of condensers, however, introduced other difficulties, which had led the lecturer in 1898 to abolish the sending condenser and replace it at the receiving end by his "magnetic shunt" placed across the suspended coil of the siphon recorder or relay.

The "magnetic shunt" consists of an insulated copper wire wound round a closed circuited iron core. The resistance of the shunt is about 30 ohms. Its inductance varies up to a maximum of from 20 to 40 henries, and its weight from 1 to 3 cwt. In the case of the siphon recorder used as a receiver, the shunt short circuits the coil, and the series condenser is abolished. In the case of a cable relay, the series condenser is usually retained to ensure that earth currents are effectually stopped, but the condenser is made large. A shunt inductance has a similar time action on the incoming current to that of a series condenser, and it helps also to reduce the phase distortion of current with voltage.

Having obtained the best results with the shunt alone, it was discovered that by using a condenser as an additional shunt, the size of the signals on the recorder got larger and more distinct. For the highest frequencies of cable signalling, the shunts of inductance and capacity, when properly proportioned, act as a shunt of infinite resistance. For lower frequencies, it is as if there were no inductance, but only a condenser.

After referring to the necessity of maintaining an accurate balance between the real and the artificial cable in duplex signalling, Mr. Brown stated that it was found necessary to maintain still more perfect balances for his new method. The balance must be maintained to within the proportion of 72,000 to 1, as against 8,000 to 1 in the older method. The very greatest care had to be directed to questions of insulation and temperature correction, and special appliances were supplied to obtain this high degree of accuracy. In fact, the future of "high-speed" working was locked up very much with this question of more delicate and more accurate balances.

Ever since the invention of the Kelvin siphon recorder, efforts had been made to turn it into a relay, but the extreme feebleness of the received signalling currents was such that they were incapable of opening and closing a battery circuit so as to do useful work in that circuit. Another difficulty was the want of definition in the

signals received to operate a relay; they were too ill-defined, and the zero lines wandered too greatly. These two difficulties were claimed to be overcome by Mr. Brown's contact-making device known as the "Drum" cable relay, worked in connection with the magnetic shunt. This drum cable relay brings a fresh source of energy from a local battery, so that the electric signalling impulses are multiplied many times over in power, and are thus enabled to do several useful things besides inking the message. They can, for instance, work signalling keys to retransmit the message on to another line, or guide the levers of an automatic punching machine to perforate the message.

The drum cable relay is very similar to the siphon recorder. It is the same so far as the suspended coil and connecting fibres are concerned, but in place of the siphon tube, a relay contact arm is provided. The end of this arm presses upon the surface of a revolving drum. The outer drum surface, composed of gold or silver, is divided into three parts:—A narrow insulated portion in the centre upon which the end of the contact arm normally rests when no signals are received, and wider portions on either side which are included in the circuit of a local battery, and two Post Office pattern relays. When the relay arm is deflected upon the receipt of the signal, it slides into contact with one of the outer portions of the drum, and thus closes the circuit of the battery through one or other of the Post Office relays. To reduce the electrical resistance that is found to exist in the contact between the pointer and the revolving drum, and to allow a large current to pass, condensers are placed across to short-circuit the contact. These short-circuit condensers are very important to the proper working of the relay, as without their aid very little current indeed could be obtained in the local circuit. The operation of the relay throughout is quite automatic and reliable, and no clerk is required to supervise. The drum relay has two properties that particularly fit it for cable work: firstly, the relay contact is always properly made, because the contact arm never leaves the surface of the drum; and secondly, by the rotation of the drum the friction of the pointer is reduced to a remarkable degree, so that the arm may be moved by the extremely feeble forces received at the end of the cable. The relay has a fixed mechanical zero, which is the centre of the insulated portion of the drum to which the end of the arm must return after every signal or group of signals. The zero of the electrical signal has been made by electrical adjustment to coincide with the mechanical zero, thus preventing mutilation of the re-transmitted signals. The working of the relay is complicated by the requirements of the service which demand that a condenser should be included in the suspended coil circuit. The object of this condenser is to exclude the possibility of interference from "earth" currents which sometimes flow along the cable. These earth currents, if allowed to flow through the suspended coil, would produce deflections that would interfere with the proper working of the relay. The magnetic shunt, which is always placed across the coil, shunts the earth current to a very great extent, but does not always get rid of it; and so, to make matters sure, an "unshunted" series condenser is included in the system. The condenser, unfortunately, polarises or charges up under a series of signalling impulses of the same polarity or sign, and for this reason itself causes a wandering of the electrical zero of the signals. The effect of the wandering zero due to the series condenser can be cured, because the wandering, unlike that of the earth currents, follows the regular law of the signals themselves. Current is, therefore, taken from the local circuit, and passed through an electrical retarding device, which is called the "local correction circuit," consisting of a series of inductances and shunting resistances. The local circuit is so adjusted as to value that the current at the far end rises exactly as there is a drop in the received signalling current through the series condenser. The correction current is passed through a separate winding on the suspended coil of the relay, and produces an effect on the coil exactly opposite to that produced on the main winding by the variable zero itself; that is to say, two variable zeros of equal strength, but of opposite directions, are super-imposed on the suspended coil and thus neutralise one another, and the variable zero of the signals themselves is thus eliminated.

The lecturer then proceeded to describe his method of high-speed working by means of a special type of relay. The principle of operating this method is based on the fact that when a submarine cable is forced much beyond its normal speed of working, the quick changing signals such as make up the letter "C" are the first to fail, or, in other words, do not arrive with sufficient strength to work the receiver. It was found on trial that by allowing more of the current from the cable to flow through the receiver, say by increasing the size of the receiving condenser, the first and last signal of a series of reversals could be obtained with sufficient strength efficiently to work the relay. The relay once started is arranged to bring in fresh energy from its local battery through a special retarding circuit to add to the strength of the quick changing currents on its own coil, and thus the reversals are made strong enough to give a record which, without this aid, they would have been unable to do. By this means weak signals are built up at the receiving end of the cable, and the speed of working can thus be materially increased. It is fortunate that the class of signals that has the greatest difficulty in getting through the cable is the easiest to be added to when received. The high speed relay works therefore not from the signals received from the cable only, but also from those that it transmits through its own local circuit, the record that it makes being the combined action of the two.

The cable over which Mr. Brown's tests have taken place stretches from Porthcurnow, in Cornwall, to Gibraltar, and is normally worked at 170 letters per minute each way with a siphon recorder as receiver. With the new method, using a special relay, duplex traffic has been carried continuously at from 230 to 240 letters per minute. On special trial runs, not carrying traffic and not sending into the cable at the receiving station, although on duplex conditions, a speed of 280 letters per minute has been attained.

The Dielectric Strength of Compressed Air.

By E. A. Watson, B.Sc.Eng., Student.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, March 11th*, 1909.)

Experiments were made by the author with the object of determining as accurately as possible the manner in which the dielectric strength of air changes when it is compressed to pressures higher than atmospheric, chiefly with a view to its employment for the insulation of certain classes of high-tension apparatus for which oil or other insulation is not suitable.

The measurements made were designed to carry the air pressure up to 200 lb. per sq. in. (say 15 atmospheres), and to such a voltage that the readings obtained should truly represent the dielectric strength of the air itself, and should not be complicated by effects having their origin at the surface of the electrodes.

Spherical electrodes were employed. These have the advantage that the maximum dielectric stress is calculable when the voltage, distance apart, and diameter of the spheres are known. In a paper by Dr. Russell on the "Dielectric Strength of Insulating Materials" (*Journal*, Institution of Electrical Engineers, Vol. 40, Part 187, p. 6), the following formula is given:—$R = v/x \times f$, where R is the dielectric stress at the surface of the sphere, v the potential difference between them, x their distance apart, and f a function of x/a, a being the radius of the spheres employed.

The values of f for different values of x/a are given by him in the paper above referred to, and have been used in this work for deriving the true dielectric stress from the observed breakdown voltage.

Points, although adopted by the American Institute of Electrical Engineers as a standard form of gap, are not to be recommended, as the point is always surrounded by a body of disrupted air of uncertain shape and dimensions.

Dr. Russell has shown theoretically in the case of a spherical electrode that if $x < 2\,a$, disruptive discharge will ensue as soon as the maximum dielectric stress at the surface of the spheres reaches the dielectric strength of the air; whereas if $x > 2\,a$, the first effect which occurs if the dielectric stress exceeds the dielectric strength is not as before a disruptive discharge, but is to cause a zone of disrupted air to form around the sphere, increasing its virtual radius so as to diminish R and reach a stable condition. As V increases the radius of this zone grows larger, until a point is reached where discharge takes place. This theoretical result is supported by consideration of any batch of spark-length voltage curves for spherical electrodes.

If we take any such series, and choose some distance apart of the centres of the spheres, we can from the curves determine the breakdown voltage for any sphere placed on those centres. This will generally be found to have a maximum value when the distance apart of the spheres is approximately equal to their diameter—*i.e.*, when $x = 2\,a$.

Hence we should expect that as soon as the distance apart of the spheres exceeded their diameter, a corona or zone of disrupted air would form before actual disruption took place, and the relation between the voltage and gap length would change.

It was actually found, however, that although if the voltage was sufficiently high a corona could be obtained, and that when this was the case the shape of the curve changed; yet this did not take place until the distance between the electrodes was many times greater than that given by the theory.

This is well shown in fig. 1, in which are given the curves obtained for spheres of radii 1·27 cm. (0·5 in.), 0·3175 cm. (0·125 in.) and 0·1588 cm. (0·0625 in.) respectively, and also for needle-points. It will be noted that the needle-point curve is a straight line.

It was observed during the experiments that the first visible appearance of a corona coincided with the point at which the curve commenced to turn up again, and occurred at or about the point where it cut the needle-point line.

The chief discrepancy lies in the fact that the gap at which the corona was first observed, and for which the curve first showed signs of turning up, instead of being equal to the diameter of the spheres employed, was in the case of the smallest spheres about six times as great. This appears to point to the possibility that the layers of air near the surface of the electrode have a greater dielectric strength than the main body.

With this exception the results of the experiments agreed very fairly indeed with theory. This was especially the case with the values of the maximum dielectric stress as deduced from the breakdown voltage, with the aid of Russell's formula, the results rarely differing from the mean value by more than 1 per cent., and then only in an irregular way, evidently due to errors of measurement, provided that the gap was not too small.

Two sets of measurements were made, with alternating-current pressures derived from a step-up transformer, and with direct-current ones from an influence machine.

Fig. 2 shows the curves obtained with spheres 1 in. in diameter using alternating current. They are very nearly straight lines, as the distance apart was in all cases, except that at the atmospheric

pressure, small compared to the diameter of the spheres. Fig. 3 gives results obtained with ⅛-in. (0·3175 cm.) spheres, showing that the spark length is not inversely proportional to the gas pressure.

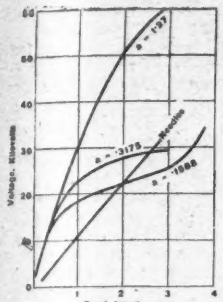

Fig. 1.—Showing Effect of Electrode Shape on Breakdown Voltage.

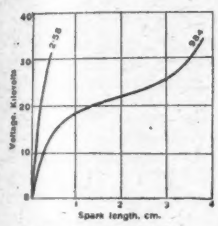

Fig. 3.—0·3175-cm. Spheres, A.C.

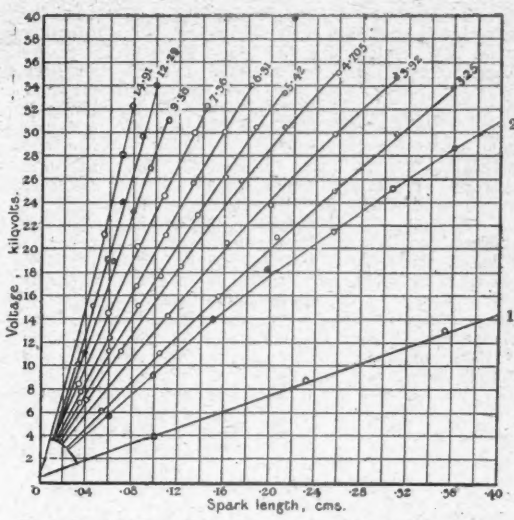

Fig. 2.—2·54-cm. Spheres, Alternating Current.

The numbers on the curves give the air-pressure in atmospheres.

To take an extreme case, we see from reference to the two curves in fig. 3 that a voltage of 24 kilovolts will spark 2·53 cm. at atmospheric pressure, but only 0·26 cm., or little more than $\frac{1}{10}$th of this amount, under a pressure of 2·58 atmospheres or 23 lb. per sq. in.

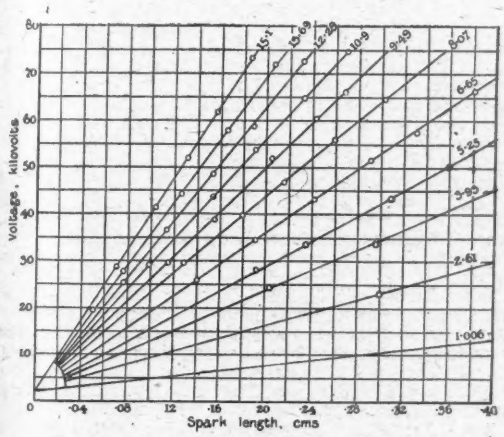

Fig. 4.—2·54-cm. Spheres, Direct Current.

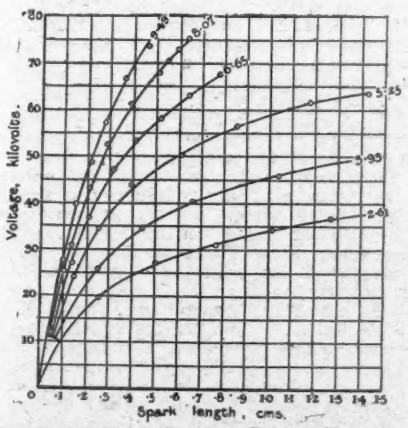

Fig. 5.—0·3175-cm. Spheres, Direct Current.

Hence under certain conditions a small increase in the air pressure will effect a very great decrease in the liability to breakdown.

Fig. 4 shows the curves obtained with the larger spheres using direct current. The fact that although taken with higher voltages these are much nearer to straight lines than the corresponding alternating ones, is probably due to the distance in the case of the alternating ones being small.

It should be noted that the direct-current voltage distance curves appear to radiate from a point whose ordinate is about 3 kilovolts. The alternating tests appear to show that they do not really pass through this point but bend round and cut the axis at a value considerably lower than this. (Note: Minimum voltage required to produce a spark in air.)

Fig. 5 shows curves for the small spheres (0·3175 cm. diameter) obtained with direct current. These are similar to the alternating-current ones, but, of course, bend over more. It will be noticed that the three lowest pressures stop against a vertical instead of a horizontal limit, due to the formation of a corona on the electrodes. The fact that all these curves stop at the same gap length shows that the distance apart at which the corona forms is independent of the gas pressure and depends only on the shape of the electrodes. This shows that it is not possible to prevent the formation of a corona on a spark-gap previous to the actual discharge merely by placing it in compressed air. If a given gap gives a brush discharge before a spark in ordinary air, it will also do so under pressure.

In attempting to deduce some standard figures for the dielectric strength of air from the results given, only the direct-current measurements have been employed.

The results obtained are plotted in fig. 6. For the largest spheres the mean value of the measurements at atmospheric pressure gave 38·85 K.V.-cm. as the dielectric strength of air. This agrees very well with the figures given by Dr. Russell.

For practical purposes we may take the lower curve of fig. 5 as being nearly correct, and, if anything, on the safe side.

The actual values of the dielectric strength can be obtained from the curves given. The equation—

$$\text{Dielectric strength} = 20 + 25{\cdot}6\ (\text{pressure})$$

expresses the relation with sufficient accuracy between the pressures of 3 and 15 atmospheres absolute.

It will be seen that, under pressures readily obtained in engineering work, the dielectric strength reaches high values,

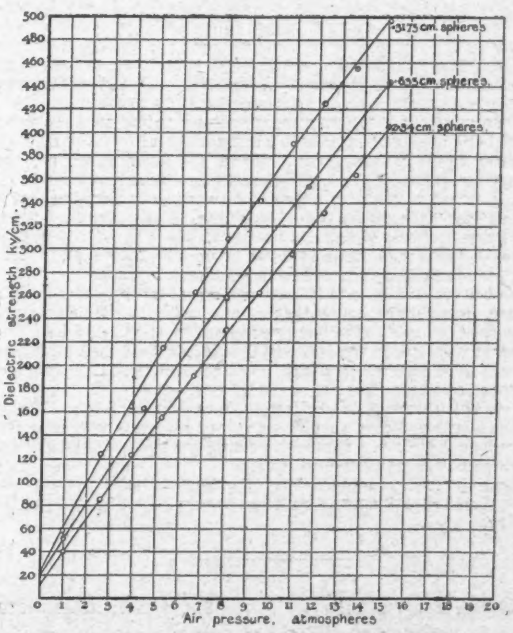

Fig. 6.—Relation between Dielectric Strength and Air Pressure.

equal to that of a solid or liquid dielectric. Compressed air as an insulation has considerable possibilities for certain cases, as it is free from viscosity and residual charge effects, and is not permanently injured if it is broken down.

Discussion.

In the discussion Dr. Alex. Russell pointed out that his own formula for the dielectric stress at the surface of a sphere could not be used when the electrodes were close together, nor for high-frequency pressures such as occurred in wireless telegraphy.

Mr. C. O. Paterson queried the effect of polish on the spheres, and of ozonised air in the testing cylinder, on the author's results. He had recently found, by testing, that the dielectric strength of ebonite varied from 50,000 to 100,000 volts per mm. Taking into account the author's results, he concluded that large factors of safety were necessary in condenser apparatus.

Prof. Kapp thought that experiments at pressures below atmospheric pressure would have considerable value in conjunction with the working of transmission wires in high altitudes. One wanted to know the point when brush discharge commenced, as this was the point where the line became inefficient.

Mr. E. H. Rayner referred to the importance of fixing the earth potential in experiments such as the author's—the Russell formulæ provided two values for *f*. He much doubted whether correct results as to dielectric strength could be obtained with a succession of sparks, as the air in the gap would become ozonised.

Dr. Morris described a modified condenser which would avoid brush discharge troubles.

Prof. S. P. Thompson suggested that varying dielectric capacity in the layers of air might account for the greater dielectric strength of the layers of air near an electrode. He thought there was some discrepancy between the several curves given by the author.

The Author, in reply, said he could detect scarcely any ozone in the spark gap, and owing to the small amount of energy in the sparks, a succession of them made no difference to the results. He considered that the discrepancies in the curves were due to uneven flux distribution with small spheres.

Physical Society.

At the meeting held on March 12th, 1909, a paper by Mr. A. E. Garrett on "The Effect of Radiations on the Brush Discharge" was read by the author.

Mr. A. E. Snow read a paper on "Pirani's Method of Measuring the Self-inductance of a Coil."

Mr. W. S. Tucker read a paper entitled "Exhibition of a High-Potential Primary Battery." The object of the battery is to maintain at known potentials such conductors as the needle of the quadrant-electrometer, for charging condensers in capacity and insulation tests, or for calibrating electrostatic voltmeters. It is composed of a large number of elements in series, consisting of carbon and pure zinc, with a nearly saturated solution of calcium chloride as electrolyte. The carbon is a piece of black-lead pencil about 5 cm. long. A strip of zinc-foil about 5 mm. wide is bound to one extremity of the carbon by thin copper wire, and the strip is bent so that its other end nearly touches the carbon of the next element. This contact is just broken by paraffin-wax. The connected ends are melted into a table of paraffin-wax contained in a shallow tray. Elements are mounted in parallel rows, the ends of alternate rows being connected to brass terminals. In the battery exhibited, 900 of these elements were arranged in series. The table of wax with the elements is then inverted, and the exposed ends of the elements dipped in a shallow tray containing the solution, and then withdrawn as quickly as possible. When withdrawn, each carbon-zinc pair is now separated by a layer of solution held in place by capillary effect. The hygroscopic nature of the solution prevents its drying up, and it is found that there is no appreciable chemical waste by local action. When not required for use, the battery can be washed free of the exciting solution and dried.

It is found possible to obtain 1·02 volt per element, so that a total of over 900 volts is given. Since the terminals are well insulated, a very steady voltage is obtained, and this has been kept within $\frac{1}{10}$ per cent. variation for two hours and 1 per cent. for half a day, the temperature of the room remaining steady.

The battery has fitted to it an arrangement whereby any desired voltage, from that of one to that of all the cells, can be obtained by steps of one cell. The last two rows of elements may be introduced at will, and in the last row the elements are each connected to brass studs over which a sliding contact can pass. This contact is connected to the terminal of the battery.

A special feature of the battery is its careful insulation. It may also be mentioned that, should any row of elements get polarised, they gradually recover, apparently owing to the depolarising action of the porous graphite exposed to air.

Short-circuiting caused a fall of potential, but there was not much chemical action on account of the very high resistance of the battery.

Electrical Transmission of Power for Marine Propulsion.

A meeting of the Institute of Marine Engineers was held in the London Institution on Monday, March 15th, when Mr. W. P. Durtnall replied to the discussion on his paper (see Electrical Review, August 14th and November 20th, 1908).

Communications were read by Mr. A. E. Sharp (member), from Mr. H. A. Mavor, of Glasgow, and T. R. Stuart. Mr. Mavor stated that the difficulty was to obtain a three-phase alternating-current induction motor to run at three or more speeds and be reasonably efficient, and that Mr. Durtnall's proposal to parallel the generators was open to some objection. The case for electrical propulsion was fairly substantiated, and was engaging the attention of the leading shipbuilders all over the kingdom. Mr. Stuart modified his opinion, expressed at a previous meeting, and after seeing certain large dynamos and induction motors at work, said he believed the rotor would be absolutely unaffected by occasional splashes of water, and the perfect insulation of the windings of the stator would enable them to stand considerable wetness without deterioration; the slip-rings, he considered, would not stand such treatment. If the electrical plant were isolated he did not see any serious objection to the system.

Mr. Durtnall, in the course of a very full reply to the whole of the discussions, described the system he advocated as being designed for the purpose of enabling the turbines in turbine-driven ships to be run at the highest speed to obtain efficient running, while the propellers, at the same time, could be run at the speed most suitable to their propulsive efficiency. He estimated that there would be a saving of from 35 per cent. to 40 per cent., as compared with existing turbine-driven ships, and 20 per cent. to 30 per cent., as compared with reciprocating engine ships. The chief defects in direct-coupled turbines for ship propulsion were the leakage of steam through tip clearance; the fact that the highest turbine efficiency was not consistent with the highest propeller efficiency; the inability to reverse; the great increase in steam consumption at low vessel speeds, and when manœuvring, &c. These defects would be overcome by "all-electric" transmission with the polyphase induction motor and squirrel-cage rotor. The system could be successfully applied to oil and gas engines for marine propulsion. He proposed to vary the periodicity of the whole system by means of connections and "floating fields" in the generators, by this means obtaining any intermediate speed that could be obtained with continuous current. He estimated that the cost would work out, on the average, at about £4 10s. per kilowatt for turbine generators, motors and controlling gear, although in small power boats this amount would be largely exceeded. The slip-rings used in the system carried very little current, and were very unlikely to get out of order. For manœuvring purposes he proposed running the starboard and port sets independently, and when the vessel commenced a continuous run, to parallel up by means of a cross connection like a pair of bus-bars. This course was justified by the increased propulsive efficiency obtained due to the rolling of the ship and the variations in the depth of immersion of the propellers. A kind of differential couple between the motors was formed, and while one propeller kept its speed at the deeper immersion, increasing the propulsive efficiency, the lightly immersed propeller did not take so much current from the generator.

Catalogues and Lists.—The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.—New list, No. 174, containing a brief description with tabulated prices, &c., of auto-transformers and balancers for metal-filament lamps.

Messrs. Mavor & Coulson, Ltd., 47, King Street, Mile End, Glasgow.—March date card, giving diagram and data relating to a Pick-Quick coal-cutter holing in a band.

Messrs. Joseph Adamson & Co., Hyde.—Illustrated leaflets describing their crane controllers, and the method of erecting and testing cranes in their works.

Mr. G. Wuthrich, London, W.C.—Illustrated list describing the Oerlikon electric hoist for builders and constructional engineers.

Messrs. Crompton & Co., Ltd., Salisbury House, E.C.—List No. U 18, giving information regarding their horse-power meters.

The Auto-Controller and Switch Co., Simplex Works, Vienna Road, Bermondsey S.E.—New circular just issued regarding their "Fluxite" paste flux for soft soldering and lead jointing. The list (copies of which are available for the trade) has a blank space at foot on one side for the name of the selling firm to be printed.

Messrs. Baxter & Caunter, 86, Charing Cross Road, W.C.—List tabulating prices of auto-transformers for use in connection with the "Z" metallic-filament lamps of which particulars and prices appear in a separate leaflet.

Messrs. B. Gibbons, Jun., Ltd., Dibdale Works, Dudley.—New illustrated catalogue of 140 pages, giving information relating to their fire-clay goods, including bricks for furnace and other service, retort-setting blocks, producer blocks, boiler-seating blocks, &c. The catalogue is well got up, and it has useful notes, tables and memoranda. It contains much that should be useful to engineers—power station and otherwise.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.—Catalogue No. 513 (fully illustrated) in which are describing the Siemens electric signalling apparatus for mines, &c. The system employed is new to this country, but it has been installed extensively in other countries. Full particulars are given of the system as applied for general and mining purposes respectively. As an adjunct, a range of mining telephones, line selectors, bells and other accessories, is included. The illuminated signalling apparatus for use as level indicators and as safety devices, for cages with several decks, also the safety depth indicator and speed regulator, are shown.

The A.E.G. Co. of South Africa, Ltd., Caxton House, Westminster, S.W.—Several new publications as follows:—Thirty-two page catalogue, giving a full description with many line diagrams and half-tone views of the A.E.G.-Curtis steam turbine for central electricity works and marine service; leaflet "E.D. 157," illustrating Holophane globes for metal-filament lamps; circular concerning the very large output of generators, motors, and other plant and electrical apparatus of the A.E.G., giving also some information regarding the works; 16-page List 5, particularising brake-lifting magnets and motors; also a publication effectively showing illustrations of electrical illumination outlines for large buildings by means of flexible strip. Ceiling illuminations and electrical advertising signs are also included.

PARLIAMENTARY.

Liverpool Corporation.

On March 18th a Select Committee of the House of Lords (Lord Newton presiding) commenced the consideration of the Bill promoted by the Liverpool Corporation. Mr. Balfour Browne, K.C., with Mr. J. D. Fitzgerald, represented the petitioners, and Mr. Lewis Coward, K.C., with Mr. Lankester, and Mr. Robertson, appeared for the L. & N.W. Railway, petitioners against the Bill.

Mr. Balfour Browne, K.C., in presenting the case for the promoters, said that the Bill authorised the Corporation to execute street improvements, and to construct tramways. Part 3 of the Bill contained the clause relating to the tramways; the Corporation asked power to construct six lines of tramways in different parts of the city. Some of them would be new lines, and other extensions of existing lines. They originally had in the Bill proposals for the construction of the trackless trolley system, but the Corporation had decided not to proceed with that, and accordingly they had struck it out of the Bill. There were originally several petitions against the measure, but the only one now remaining was that of the L. & N.W. Railway, who contended that the proposals would affect their undertaking.

Sir Charles Petrie gave evidence in support of the Bill, and Mr. Lewis Coward, K.C., cross-examined Witness on behalf of the Railway Co., which contended that the line would be unremunerative, and that the district was already served.

Mr. Mallins, general manager of the tramways, and Mr. J. A. Brodie also gave evidence. Mr. Percy Sellon gave evidence for the Railway Co. against the scheme.

Mr. Fitzgerald, in reply, said that the objection of the Railway Co. was that the Bill would be competitive; yet Mr. Turnbull, for the company, had said that his clients were providing such an efficient service that the Corporation could not possibly effectually compete with them. The witnesses for the Corporation had told the Committee that judging by the working of the tramways since 1897, when they took them over, they were confident that the lines would pay. He asked the Committee to set aside the evidence of Mr. Sellon, and not to put it in comparison with the evidence of gentlemen who were intimately acquainted with the undertaking.

The Committee having deliberated in private, the chairman announced that the preamble of the Bill was proved.

Southport and Lytham Tramroad.—This Bill came before a Select Committee of the House of Lords on March 18th. The measure authorises the abandonment of the undertaking constructed under the Act of 1899. An application for postponement was acceded to.

Folkestone, Sandgate and Hythe Tramways.—Capt. Faber has given notice of his intention to move, on the second reading of the above Bill, that the Committee be instructed to strike out all powers for erecting overhead wires or posts.

Swinton and Mexborough Tramways.—In Tuesday's Parliamentary Papers Capt. Faber asked the President of the Board of Trade whether he would state why that department objected to the Dolter system of surface-contact lines as used at Swinton and Mexborough.—Mr. Tennant replied that complaints were made of the frequent occurrence of live studs on the tramways, and these complaints were brought to the notice of the company by the Board. The company decided on their own initiative to replace the Dolter system by the overhead system.

Anglo-Argentine Tramways Bill.—On Tuesday this Bill passed third reading in the House of Lords.

North Metropolitan Electric Power Supply Bill.—This Bill was read a third time in the House of Commons on Tuesday.

Smoke Nuisance in London.—At a recent conference of representatives of the Public Control Committee of the L.C.C. with delegates of the Corporation of the City of London and metropolitan borough councils on the subject of the provisions of the Public Health (London) Act, 1891, dealing with nuisances arising from smoke emissions, the following resolutions were passed: (1) That Sec. 24 (*b*) of the Act, which provides that any chimney (not being the chimney of a private dwelling house) sending forth black smoke in such quantity as to be a nuisance shall be liable to be dealt with summarily under the Act, should be amended by the deletion of the word "black"; (2) that the word "chimney" in Sec. 24 (*b*) should be deemed to include chimneys of Government workshops and factories; (3) that in special cases of nuisances arising under Secs. 23 and 24 of the Act, the proceedings in respect of any nuisance may, at the request of, and by agreement with, the sanitary authority, be taken by the L.C.C. in such special cases.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

CANADA.

(*Continued from page 500.*)

Brass wire, plain	7½% ad val.
Copper wire, plain, tinned or plated	7½% ad val.
Anodes of nickel, zinc, copper, silver or gold	5% ad val.
Iron and steel railway bars or rails of any form, punched or not, n.o.p., for railways, which term for the purposes of this item shall include all kinds of railways, street railways, and tramways, even although they are used for private purposes only, and even although they are not used or intended to be used in connection with the business of common carrying of goods or passengers	$4.50 per ton.
Iron or steel railway bars or rails, which have been in use in the tracks of railways in Canada, and which have been exported from Canada and returned thereto after having been re-rolled, and weighing not less than 56 lb. per lineal yard when re-rolled, and which are to be used by the railway company importing them on its own tracks, under regulations prescribed by the Minister of Customs	25% ad val.
Provided that the value for duty of such re-rolled rails shall be the cost of re-rolling the same.	
Provided also that whenever the Governor in Council is satisfied that a mill adapted and equipped for re-rolling such rails in substantial quantities has been established in Canada, the Governor in Council may by order in Council to be published in the *Canada Gazette*, abolish the duty specified in this item, and thereupon all such rails when imported shall be subject to such duty as otherwise provided in the Customs Tariff.	
Railway fish-plates and tie-plates (per ton)	$5.00
Switches, frogs, crossings and intersections for railways	20% ad val.
Iron or steel bridges, or parts thereof; iron or steel structural work, columns, shapes or sections, drilled, punched or in any further stage of manufacture than as rolled or cast, n.o.p.	22½%
Springs, axles, axle bars, n.o.p., and axle blanks, and parts thereof, of iron or steel, for railway, tramway or other vehicles	22½%
Forgings of iron or steel of whatever shape or size or in whatever stage of manufacture, n.o.p.; and steel shafting, turned, compressed or polished; and hammered, drawn or cold-rolled iron or steel bars or shapes, n.o.p.	20%
Round polished steel shafting, in bars not exceeding 2½ in. in diameter	17½%
Cast-iron pipes of every description (per ton)	$6.00
Wrought or seamless iron or steel tubes for boilers, n.o.p., under regulations prescribed by the Minister of Customs; flues and corrugated tubes for marine boilers	free
Tubes of rolled iron or steel, not joined or welded, not more than 1½ in. in diameter	free
Wrought-iron tubing, butt or lap-welded, threaded or coupled or not, over 4 in. in diameter, imported for use exclusively in mining or metallurgical operations	free
Seamless steel tubing, valued at not less than 1·72d. per lb.; also rolled or drawn square tubing, adapted for use in the manufacture of agricultural implements	free
Wrought or seamless tubing, plain or galvanised, threaded and coupled or not, over 4 in. in dia.	10% ad val.
Wrought or seamless tubing, plain or galvanised, threaded and coupled or not, 4 in. or less in dia.	20% ad val.
Other pipe or tubing, plain or galvanised, riveted, corrugated, or otherwise specially manufactured, including lock-joint pipe	20% ad val.

(*To be concluded.*)

New Use for Electric Cooking.—A novel application of electric cooking, which has been brought to our notice, will serve to show that the public are commencing to recognise the practicability and convenience of this art. Under the auspices of the Gordon League, Miss Hope has arranged a series of six cooking lectures for poor women. The demonstrations take place at the Cavendish Rooms, Mortimer Street, and the whole of the cooking apparatus is electrical, the greater part of it having been loaned by the electricity department of the borough of Marylebone. The outfit comprises a complete Phœnix range employing ordinary utensils, and independent kettles, saucepans, grills, irons and radiators. One lecture has already been delivered, and the arrangements have given great satisfaction to all concerned. This, it should be noted, is not essentially a demonstration of electric cooking; the convenience of the apparatus, its cleanliness, and freedom from fire risk, determined its selection in place of the usual gas range.

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

5,501. "Improvements relating to the electric ignition and lighting systems of automobiles and the like." R. F. Hall. March 8th.

5,512. "Improvements in and relating to illuminated advertising devices." J. O. O'Brien. (Radium Licht-Reklame Co., m.b.H. Germany.) March 8th. (Complete.)

5,544. "Improvements in or relating to systems for lighting railway trains by electricity." Siemens Bros. Dynamo Works, Ltd., F. G. Broadhead and T. F. Wall. March 8th. (Complete.)

5,563. "Improved electro-magnet." W. K. L. Dickson. March 8th.

5,564. "Improvements in and connected with automatic points for railways, electric trains and tramways." D. Puig. March 8th. (Complete.)

5,565. "Improvements relating to the electrical control of railway signals." F. Cumont and Compagnie de Signaux Electriques pour Chemins de Fer. (Date applied for under Sec. 91 of the Act, March 25th, 1908, being date of application in France.) March 8th. (Complete.)

5,566. "Improvements in telegraphic instruments." W. S. Bevan. March 8th.

5,567. "Improvements in and relating to electric candle lamps." C. C. Regnart. March 8th. (Complete.)

5,578. "Improvements in wireless telegraphy." S. Eisenstein. (Application for patent of addition to No. 10,019/08.) March 8th. (Complete.)

5,605. "Improvements in relays for the protection of electric circuits." K. Edgcumbe and E. I. Everett. March 8th.

5,611. "Electrical plug boxes." C. H. Naylor. March 9th.

5,629. "Improvements in electric accumulator sub-stations fed from alternating-current systems." A. Mills Taylor. March 9th.

5,690. "Improved means for reversing alternating-current commutator machines." H. C. E. Jacoby. (Date applied for under Rule 13, December 23rd, 1908. An invention comprised in application No. 27,967, dated December 23rd, 1908.) March 9th.

5,703. "Improvements in transformers." T. Harrison and A. S. Frazer. March 9th.

5,706. "Improvements relating to telephone mouthpieces." H. W. Lake. Gibson Manufacturing Co., United States.) March 9th. (Complete.)

5,717. "Improvements in and relating to protective devices for alternating-current systems." Allgemeine Elektricitats Ges. (Date applied for under Sec. 91 of the Act, March 12th, 1909, being date of application in Germany.) March 9th. (Complete.)

5,719. "Improved electric lamp." E. J. A. Grinyer. March 9th.

5,739. "Automatic switch for use with transformers for metallic-filament lamps." S. H. Smith, W. I. Smith and J. D. Green. March 10th.

5,751. "Improvements in electrical switches." J. H. Tucker. March 10th.

5,777. "Improvements in the method of and apparatus for electrically heating air and other media." G. G. Bell and J. St. V. Pletts. March 10th.

5,778. "Improvements in thermal relays for the protection of electric circuits." E. I. Everett and K. Edgcumbe. March 10th.

5,783. "Improvements in apparatus for using low-pressure electric lamps on alternating systems of distribution." A. W. Schlater and G. S. Boothroyd. March 10th.

5,805. "Improvements in electric switches." W. H. Flood. March 10th.

5,820. "Improvements in and relating to electric measuring instruments." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 10th.

5,828. "Improvements in devices for automatically inserting or cutting out resistance in electrical circuits." W. A. Ker. March 11th.

5,846. "New or improved switch for use in connection with sparking plugs and the like." C. H. Jones. March 11th.

5,859. "Improved electrical process for removing the grease and the yolk from wool, and apparatus therefor." R. Vandatte and B. Lagye. March 11th. Complete.)

5,883. "Improvements in self-winding electric clocks." F. Kirchhofer. March 11th. (Complete.)

5,888. "Improvements in electric motors and generators." D. Suchostawer. March 11th.

5,891. "Improvements in and connected with fixings for making attachments to walls or ceilings for electrical conductors and other purposes." J. J. Rawlings, H. W. Handcock and A. H. Dykes. March 11th.

5,893. "Improvements in spark plugs." G. P. B. Hoyt and E. L. Sinsabaugh. March 11th. (Complete.)

5,904. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) March 11th. (Complete.)

5,909. "Improvements in and relating to multiple-switch starters." H. W. Lake. (Cutler Hammer Manufacturing Co., United States.) March 11th. (Complete.)

5,935. "Improvements in electrical measuring instruments." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 11th.

5,955. "Improvements in or relating to electric sparking plugs." E. J. Twigg. March 12th.

5,958. "Improvement in the production of metallic articles by electro-deposition and in the articles so produced." F. I. Gibbs. (Date applied for under Rule 13, February 27th, 1908. An invention comprised in Application No. 4,410, dated February 27th, 1908.) March 12th.

5,959. "Improvements in metal vessels produced by electro-deposition.' F. I. Gibbs. (Date applied for under Rule 13, February 27th, 1908. An nvention comprised in Application No. 4,410, dated February 27th, 1908.) March 12th.

5,930. "Improvements in processes for producing metallic articles by electro-deposition and in the articles so produced." F. I. Gibbs. (Date applied for under Rule 13, February 27th, 1908. An invention comprised in Application No. 4,410, dated February 27th, 1908.) March 12th.

5,961. "Improvements in models for use in the formation of metal vessels by electro-deposition." F. I. Gibbs. (Date applied for under Rule 13, February 27th, 1908. An invention comprised in application No. 4,410, dated February 27th, 1908.) March 12th.

5,962. "Improvements in processes for producing metallic articles by electro-deposition and in the articles so produced." F. I. Gibbs. (Date applied for under Rule 13, February 27th, 1908. An invention comprised in application No. 4,410, dated February 27th, 1908.) March 12th.

5,996. "Improvements in and relating to switch operating means." W. J. Williams and O. J. Williams. March 12th. (Complete.)

6,004. "Improved combined tramway and telegraph pole." J. Hackett. (Date applied for under Sec. 91 of the Act, August 14th, 1908, being date of application in United States.) March 12th. (Complete.)

6,008. "Improved method of and apparatus for producing indications by received electrc magnetic waves." R. A. Fessenden. March 12th. (Complete.)

6,031. "Improvements in electrically-operated horns and trumpets and the like." Spagnoletti, Ltd., and H. M. Bayly and V. E. Joyce. March 13th.

6,049. "Improvements in the metal castings of electric fuseboards." V. Hope. March 13th.

6,065. "Improvements in means or apparatus for regulating electric currents." C. Russo. March 13th.

6,069. "Improvements in dynamo-electric machinery, especially applicable to motor-converters." Bruce Peebles & Co., Lld. (O. S. Bragstad and J. L. La Cour, Germany.) March 13th. (Complete.)

6,076. "Improvements in drums or reels for coiling and transporting electric cables, wire ropes and the like." T. Hosking. March 13th.

6,088. "Improvements in the electric production of iron and steel and other metals and in furnaces for carrying out the same." Aktiebolaget Elektrometall. (Date applied for under Sec. 91 of the Act, August 1st, 1908, being date of application in Sweden.) March 13th. (Complete.)

6,089. "Improvements in the automatic regulation of electric generators, boosters, or the like." E. Jacob, G. Carlyle Allingham and Tudor Accumulator Co., Ltd. March 13th.

6,090. "Improvements in motors." E. Doulierr. March 13th.

6,093. "Improvements in high-frequency oscillatory current generators and transformers." F. Jacoviello. March 13th. (Complete.)

6,103. "Improvements relating to alternating electric-current machines." R. Moser. (Date applied for under Sec. 91 of the Act, March 14th, 1908, being date of application in Germany,) March 13th. (Complete.)

6,105. "Contact device for use in connection with electric ignition gear of motor road vehicles." J. G. Hay. March 13th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford price, post free, 9d. (in stamps).

1907.

Single-Phase Motor Control. British Thomson-Houston Co. (Genera Electric Co., United States.) 27,849. March 17th.

1908.

Electricity Meters. G. Hookham. 12,009. June 3rd.

Magneto-Electric Ignition Apparatus. C. F. C. Wilkins and Muirhead & Co. 12,802. June 6th.

Push-Switch Lampholder for Electric Light Fittings. G. H. Ide. 12,593. June 12th.

Electric Ignition Apparatus for Internal-Combustion Engines. H. Stephens. 13,378. June 24th.

Electric Battery. H. Falk. 17,886. August 25th.

Bearing with Lubricating Device for the Armature Shaft of Electric Ignition Apparatus and the like. C. Ebner. 19,502. September 16th.

Electrical Operation of Haulage and Winding Gear. H. A. Mavor and Mavor & Coulson, Ltd. 1,450. January 21st.

Supports for Filaments in Electric Incandescent Lamps. H. Hoge and "Z" Electric Lamp Manufacturing Co. 3,248. February 13th.

Electric Servo-Motor. A. Grammont and J. L. Routin. 3,592. February 17th. (Date applied for under International Convention, February 21st, 1907.)

Electric Polyphase Induction Machines. W. Fairweather. (Allmänna Svenska Elektriska Aktiebolaget.) 4,113. February 24th.

Electrically-Driven Trackless Train. F. Wagner. 4,687. February 29th. (Date applied for under International Convention, March 16th, 1907.)

Electric Starting Switches. H. T. Harrison. 6,370. March 21st.

Electric Switch Boxes. E. Charles. 6,501. March 24th.

Electrical Contact Device. O. Engel. 6,765. March 26th. (Date applied for under International Convention, March 27th, 1907.)

Overhead Conductor Points or Frogs for Electric Tramways. W. Gray. 7,944. April 16th.

Electric Signalling Systems for Railways and the like. A. J. Boult. (Union Switch and Signal Co.) 9,851. May 6th.

Portable Interrupter for Induction Coils and Distributors of Electrical Current. A. E. Dean. 9,990. May 7th.

Apparatus for Producing Electrical Impulse Charges for Use in Wireless Telegraphy. S. Eisenstein. 10,019. May 8th.

Trolleys for Electric Tramcars. S. B. E. Ward. 11,575. May 28th. (Cognate application, 24,099/08.)

Electrolytic Cells for Separating the Constituents of a Mixture of Metals or an Alloy. Usine Genevoise de Degroissisage d'Or. 13,134. June 19th. (Date applied for under International Convention, July 11th, 1907.)

Electric Socket Switch. H. Hubbell. 13,863. June 30th.

Electrical Vibrators. J. Jerome. 16,819. August 10th.

Electrical Apparatus for Gassing Threads. G. H. Gin. 17,229. August 15th. (Application for Patent of Addition to No. 4,550/07.)

Electric Appliance for Stallions. R. Haddan. (Samborn.) 17,230. August 15th.

Cartridges for Use with Electrically-Fired Small Arms. H. Whittington. 19,620. September 18th. (Post-dated September 18th, 1908.)

Method of and Apparatus for Electroplating. G. H. Lutz. 21,349. October 8th.

Device for Cooling the Commutators of Electrical Machines by Means of Wing-Like Projections on the Segments. Allgemeine Elektricitäts Ges. 21,761. October 14th. (Date applied for under International Convention, October 15th, 1907.)

Electric Telegraphy. I. Kitsee. 22,179. October 20th.

Carbon Brush-Holders. Firm of R. Bosch. 23,362. November 2nd. (Application for Patent of Addition to No. 21,568/08.)

Wire, and the Manufacture Therefrom of Coherent Bodies of Refractory Material Suitable for Use as Glow Bodies or Filaments for Incandescent Electric Lamps. British Thomson-Houston Co. (General Electric Co., United States.) 25,557. November 26th.

Electric Generators. P. M. Justice. (A. W. Kiddle and A. M. Baumann, United States.) 27,236. December 15th.

1909.

Electro-Capillary Contrivance for Detecting and Recording Electric Impulses. A. Orling, E. Oldenbourg and C. Spiegelberg. 275. January 5th. (Date applied for under International Convention, January 6th, 1908.)

Electric Accumulator Sub-Stations. A. M. Taylor. 1,092. January 15th. (Date applied for under Rule 13, November 29th, 1907.)

Electric Fuse-Holders. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.) 1,510. January 21st.